AUTEK

INSTRUCTION MANUAL
MODEL 502

SYSTron Donner
774

AUTEK SYSTEMS CORP.
TEL. (408) 496-0400

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Equipment manufactured by Autek is warranted to be free from defects in material and workmanship for a period of one year from date of delivery (90 days for cathode-ray tubes), unless otherwise specified. Expendable parts such as fuses, lamps and operating supplies are excluded from this warranty.

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CHAPTER 1

GENERAL INFORMATION

1.1 INTRODUCTION

The Model 502 is fully programmable, dual-channel sampling oscilloscope utilizing a variety of remote sampling probes. It is especially designed for use with the Model 503 Waveform Analyzer to form an automatic waveform analyzer system. The Model 502 furnishes sampled signals which are digitally processed by the Model 503 to provide digital readout of voltage and time relationships.

Used separately as a bench instrument, the Model 502 can be operated manually by means of front panel controls. It can also be remotely programmed from a variety of ASCII sources for automatic test system use.

Some outstanding features of the Model 502 are summarized below:

- Fully programmable delay including real-time ranges, up to 10-screen diameters.
- Auto Delay mode seeks and positions signal on CRT.
- Time Bases from 1 ns/div to 0.5 s/div in 1-2-5 sequence.
- Sensitivity from 2 mV/div to 100 mV/div in 1-2-5 sequence.
- Programmable sampling probes with sensitivities to 10V/div.
- Programmable offset and trigger polarity.
- 350 ps rise time (1 GHz bandwidth) using 50-ohm probes.
- Noise less than 1 mV using X1 probes.
- Programming from front panel or ASCII Data Buss.
- Convertible to automatic waveform analyzer system by adding on the Model 503.

1.2 SPECIFICATIONS

Table 1-1 lists the specifications applicable to the Model 502.

Table 1-1 Specifications

Time Ranges:	1 ns/div to 500 ms/div in 1-2-5 sequence.
Delay Ranges:	0.0 to 9.9 X full-scale time for each range (X1 mult.) (10-screen diameters with "1" multipliers; 5-screen diameters with "2" multipliers; 2-screen diameters with "5" multipliers).
Auto Delay Mode:	Finds signal and indexes transistion on CRT.
Horizontal Display Accuracy:	±3% of full scale (see Model 502/503 Specifications for accuracy of digital measurements).

Table 1-1 Specifications (Contd)

Voltage Ranges:	2 mV/div to 100 mV/div programmed in 2-5-10 sequence using X1 remote sampling probes; Programmed up to 10V/div using programmable high-impedance probes.
Vertical Display Accuracy:	±3% of full scale (excluding attenuator errors) (see Model 502/503 Specifications for accuracy of digital measurements).
Noise:	Less than 1 mV using X1 sampling probe.
Offset:	Programmable to ±0.9V in 0.1V increments, referred to sampling bridge (X1 probe input); manual vernier approx. ±0.1V with detented zero position.
Sampling Rate:	50 Hz to 100 kHz; higher trigger rates counted down internally; real time sampling up to 500 μs/div.
Dot Density:	1000 dots full scale, shared by two channels.
Triggering:	Input impedance, 50 ohms nominal; manual Trigger Level control with Preset for normal triggering; Programmable + or -- slope selection; Trigger rise time, 0.6 μs maximum; Sinusoidal sensitivity, 100 mV min., 1-100 MHz; Trigger jitter, less than ±20 ps to 50 MHz less than 50 ps to 500 MHz (optimum trigger amplitude and trigger level control setting); Unattended Preset triggering (+ or – slope); Trigger pulse width, 0.5 to 1.5 ns; Trigger pulse amplitude, 300-900 mV; Trigger pulse frequency, to 20 MHz; maximum input, 5V; minimum trigger advance, approx. 50 ns + 2% of full scale time using "1" multipliers.
Dimensions	
Height:	5-1/4 inches (13.34 cm)
Width:	19 inches (48.26 cm)
Depth:	19 inches (48.26 cm)
Weight:	40 lbs., approx. (18.1 kg)

Table 1-1 Specifications (Contd)

Power Required:	100/115/230 Vac (±10%), 50-60 Hz, 150 watts.
Rear Panel Connectors	
A/B SIGNAL (J102 & J103)	Remote sampling probe connectors, accepts Models P21 and P20 remote sampling probes; provide trigger outputs for Model 182 Sampler MUX; 9-pin sockets, Ampenol type 165-12.
ASCII PROGRAM	For remote control; ASCII bit-parallel, serial-by-character format, TTL low-level true; 24 contact Micro Ribbon socket, Amphenol type 57-40240 mates with type 57-30240 plug.
CONTROL (to Model 503) (J105)	Provides all necessary interconnections between Model 502 and Model 503; 50-contact Micro Ribbon Socket, Amphenol type 57-40500, mates with type 57-30500 plug.
MUX CONTROL (J106)	Provides programming to remote probe multiplexer and sampled signal inputs for A and B channels when using one or more multiplexers; 36-contact Micro Ribbon socket, Amphenol type 57-40360, mates with type 57-30360.
TRIGGER (J107)	Trigger input connector for the Model 502 BNC jack, 50 ohms nominal input impedance, 5V max.

1.3 APPLICATIONS

The Model 502 Programmable Sampling Oscilloscope is especially intended to be used with the companion Model 503 Waveform Analyzer to form an automatic waveform analyzer system. At the same time it stands alone as an oscilloscope, either for manual bench use or in an automatic test system.

1.3.1 Automatic Test System

All instruments are computer controlled by means of the ASCII Data Buss. The Model 502 controls the sampling probe multiplexers, supervising up to 100 remote sampling probes. The Model 180 mainframe accepts two Model 182 10-probe multiplexers, and up to five 180 mainframes may be used in a system. The system may be operated with two probes without the use of a multiplexer, or with any number of probes up to 100 using as many 10-probe multiplexer plug-ins as required.

This system can be converted to an automatic waveform analyzer system by adding on the Model 503 Waveform Analyzer as shown in figure 1-1. The Model 503 is also computer-controlled through the ASCII Data Buss, and all necessary connections between Models 503 and 502 are

made through the single control cable. Digital data output to the computer is from a separate connector on the Model 503. Any voltage or time measurement within the capabilities of a 1 GHz bandwidth sampling oscilloscope may be made automatically using this system.

1.3.2 Internal Triggering

Internal triggering of the Model 502 can be achieved as shown in figure 1-2. In this diagram a Model 180 MUX mainframe houses a Model 181 FET Probe MUX and a Model 183 Delay Line/Trigger Conditioner plug-in. Probing is done through up to 10 of the Model P22 FET Probes. These units feature high-input impedance, programmable attenuators, with a rise time of less than 5 ns. The Model 181 is programmed through the ASCII Buss. For use with the X1, X10, X100 attenuator option must be sepcified for the Model 503 probes.

Any two of the ten FET probes may be selected simultaneously. The outputs of the two programmed probes are fed through delay lines in the Model 183., and a trigger pickoff may be taken from the input of either delay line. The delay line outputs are monitored by two 50-ohm sampling probes connected to the Model 502. Using this system it is possible to trigger the Model 502 from either signal being observed, to use one channel as a trigger while observing the other, or to derive a standardized trigger from a number of other inputs to the Model 183 Plug-In.

1.3.3 Auto Delay

Locating the signal may be difficult when using a sampling oscilloscope and this probelm is compounded in an automatic test system where the delay program must be entered into computer memory or on a paper tape. For example, it is often necessary to measure the rise time of the output signal from a "black box" when the propagation delay through the device is unknown or variable. A fast time base is needed to make the measurement with resolution and accuracy, however this requires that the delay be accurately programmed to keep the signal on screen.

The Auto Delay feature of the Model 502 meets the requirements for most measurements of this type. Using this mode of operation, the Model 502 seeks the signal and automatically sets the delay to position the signal on the display. The search range is up to 10-screen diameters, depending on time range. A measurement can then be made on an expanded time range for accuracy and resolution, even when the variation in propagation delay through the device under test is large compared to the rise time. When the signal is outside the search range of the Model 502 delay circuit, a visual indication is provided along with a Search Overrange flag to the controlling computer.

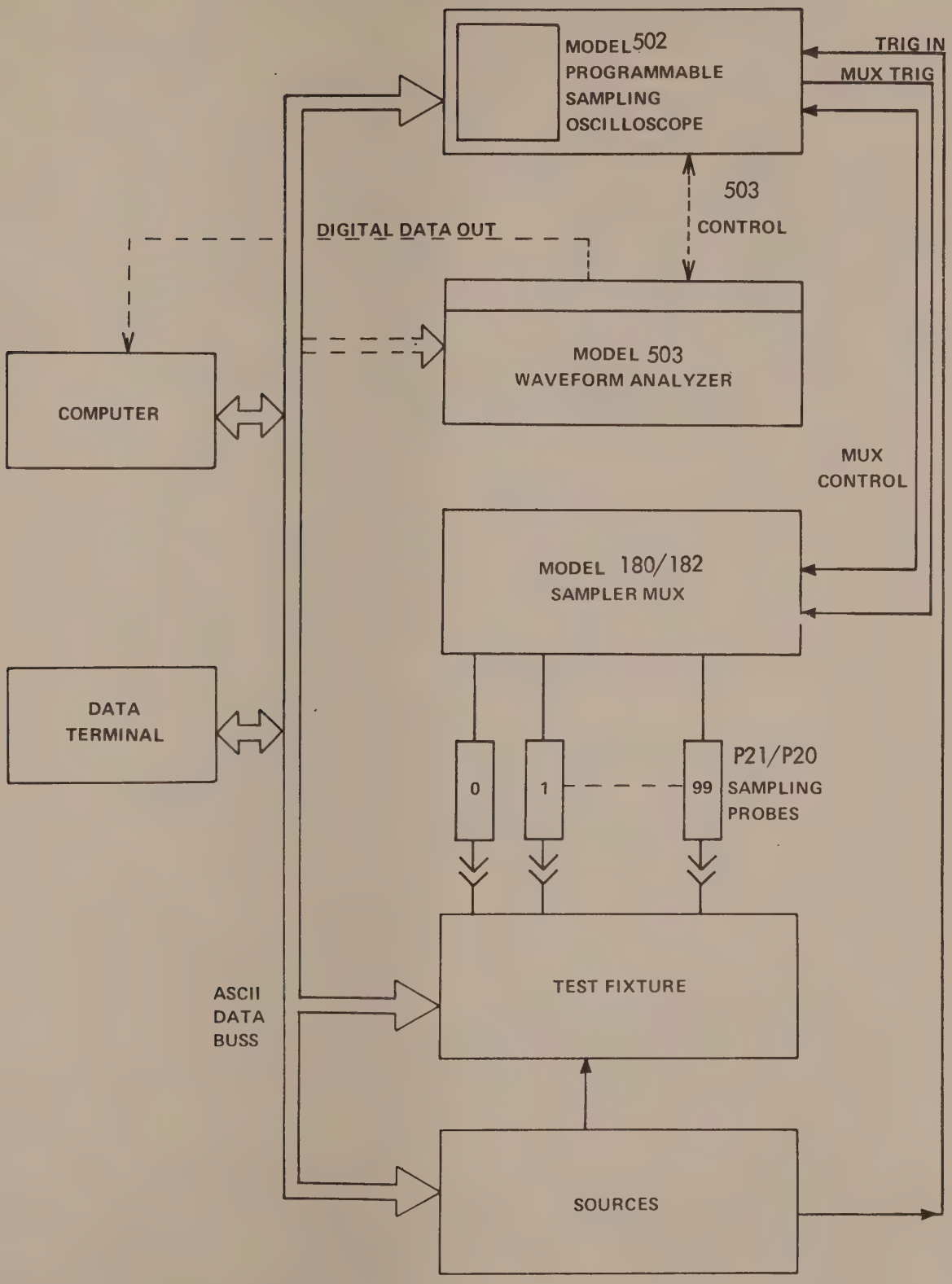


Figure 1-1. Typical System Using Model 502 With Model 503 Added-on

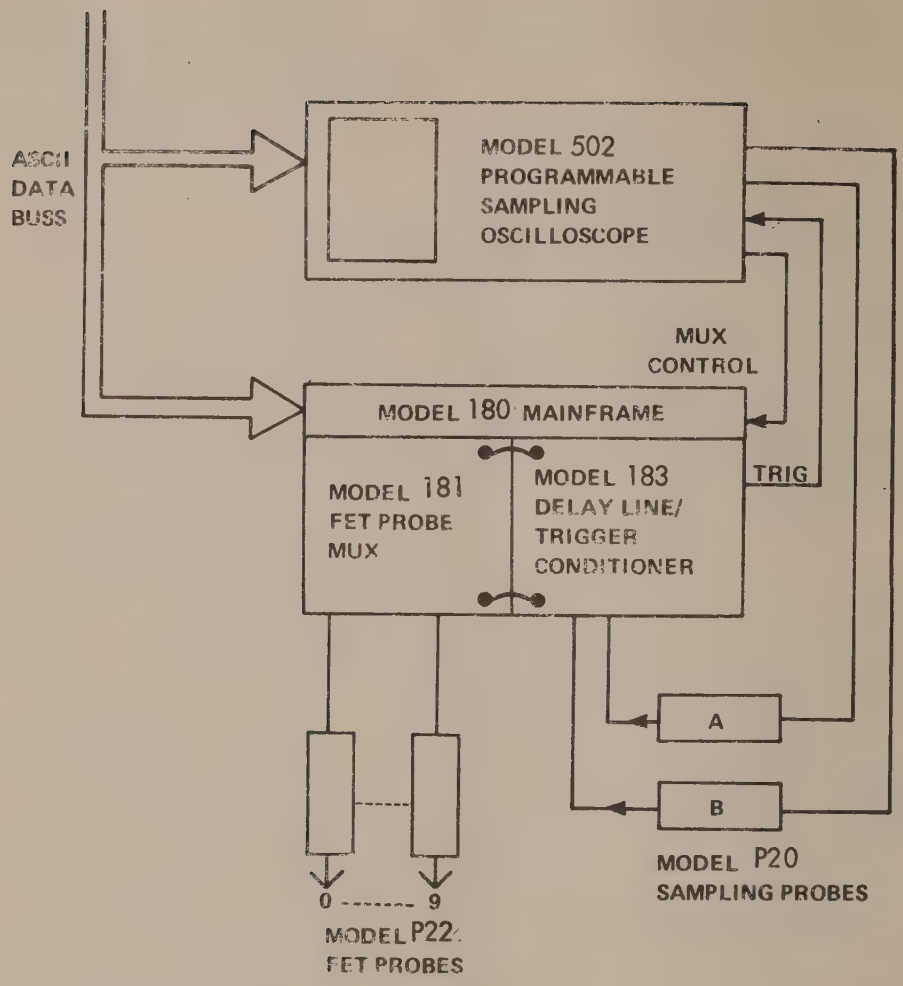


Figure 1-2. Internal Triggering Scheme Using the Model 502

CHAPTER 2

INSTALLATION

2.1 INTRODUCTION

The Model 502 Programmable Sampling Oscilloscope is shipped in an operational condition, and is essentially ready for use as received. This chapter contains unpacking, inspection, and installation information to aid in setting up the instrument for immediate use.

2.2 RECEIVING INSPECTION

As soon as the instrument is received, check the carton for evidence of damage or rough handling. If damage is found, or is suspected, notify the carrier and your Autek Systems representative. Open the shipping container only in their presence.

Use care in removing the instrument from the container. Check immediately for loose or broken controls, bent or broken connectors, and dents or scratches on the panel surfaces. If damage of any nature is found, refer to the warranty instructions in the front of this instruction manual.

All Autek Systems instruments must pass rigid inspection tests before leaving the plant. However, upon receipt, a receiving inspection test should be performed immediately after unpacking to ensure that the instrument is still operational.

2.3 INSTALLATION

2.3.1 Power

The instrument is provided with a 3-conductor power cord which grounds the case when connected through a compatible grounding outlet. If a standard ground outlet is not available, a 3-conductor adapter must be used which provides the necessary grounding connection. Make sure the rear panel line voltage switch is set for the correct power, 115 or 230V, before connecting the instrument to a power source. Also, be certain that the proper fuse, F101, is installed (2A Slo-Blo, 115 Vac; 1A Slo-Blo, 230 Vac). To change over to 100 Volt operation, internal connections to the power transformer must be changed. Transformer connections for various 50-60 Hz power lines are detailed in figure 2-1.

2.3.2 Cooling

The Model 502 design incorporates a cooling fan. Cooling air enters the case through the air filter at the rear panel, passes through the internal assemblies, and exhausts through louvers in the side panels. Care must be exercised not to obstruct the flow of air into or out of the instrument case.

2.4 STORAGE AND RESHIPMENT

Environmental conditions during storage and shipment should be limited to a maximum temperature of 85 degrees Centigrade and a minimum temperature of -55 degrees Centigrade.

To protect the instrument during shipment or storage, use the best packaging methods available. Contact the nearest Autek Systems field office for materials similar to those used in the original factory package. Contract packaging companies are also available to provide dependable custom-packaging service on short notice.

a. If at all possible use the original shipping container designed for the instrument. Otherwise, a strong carton (350 lb/sq. in. bursting strength) or wooden box should provide adequate protection. (See figure 2-2 for overall dimensions.)

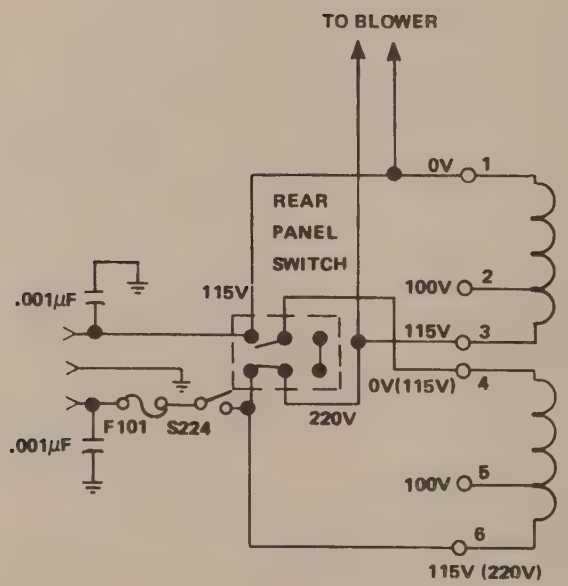
b. Wrap the instrument in heavy paper or plastic

placing it in the shipping container.

c. Completely fill the area around the instrument with packing material if the original shipping carton is not used; protect the front panel surfaces with several sheets of cardboard.

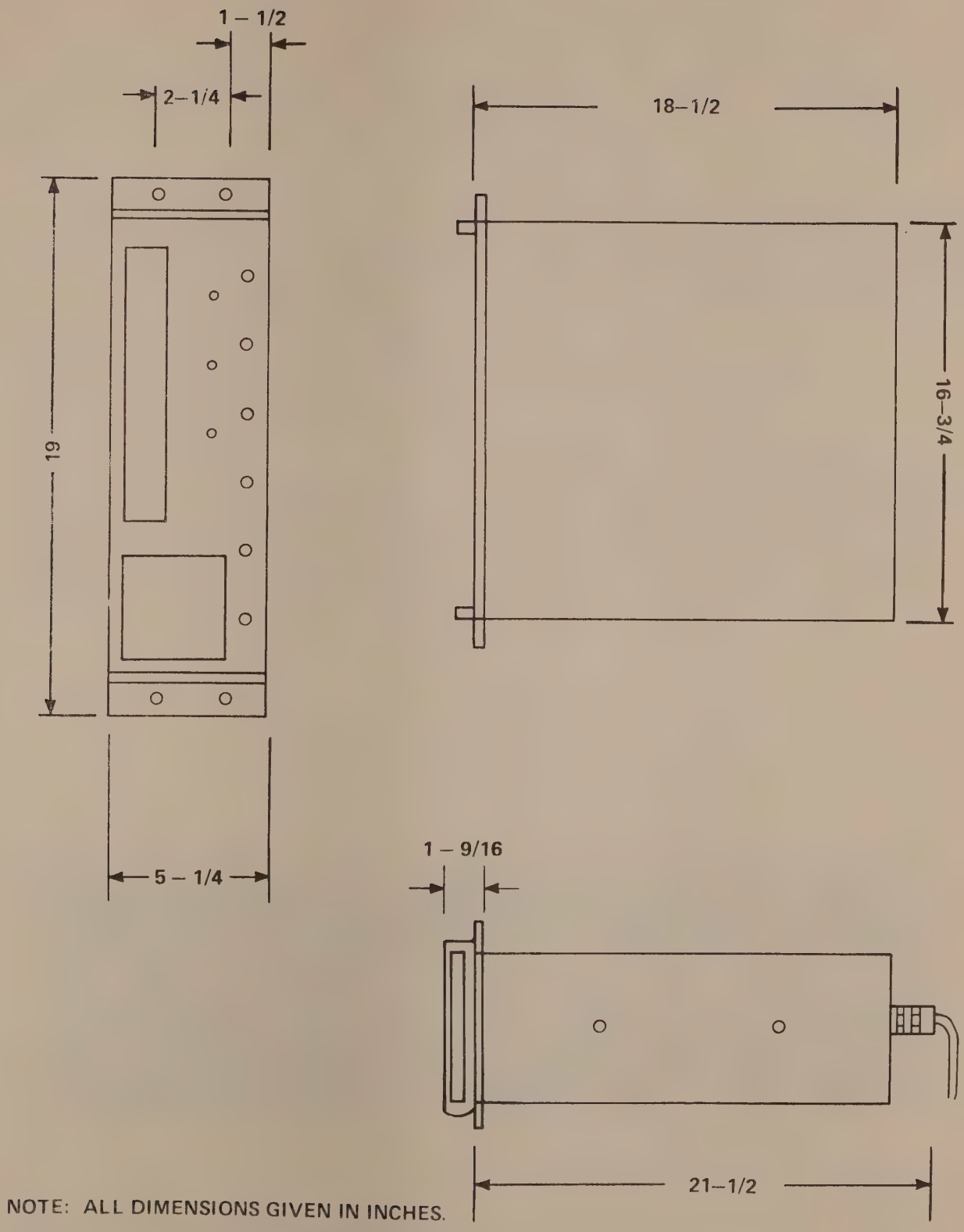
d. Seal the package with strong tape or metal bands. Mark *FRAGILE-DELICATE INSTRUMENT* on the outside of the package.

e. Refer to the warranty in this manual and check with the nearest Autek Systems field office for shipping instructions. In all correspondence, refer to the instrument by full model number and serial number.



NOTE: TRANSFORMER SHOWN CONNECTED FOR 115V

FIGURE 2-1 INPUT POWER CONNECTIONS



NOTE: ALL DIMENSIONS GIVEN IN INCHES.

FIGURE 2-2 MODEL 502 DIMENSIONS

CHAPTER 3

OPERATION

3.1 GENERAL

This chapter contains information on the location and functions of controls, input, and output connectors, a procedure for first-time turn-on, and general information on operation of the instrument. Some typical measurements are given to familiarize the operator with the principles of operation and the capabilities of the instrument. Remote programming is also discussed, and interface requirements are given.

A useful result of the particular organization of front-panel controls is that program format is the same, whether the unit is operated manually from the front panel or remotely from any of the normal ASCII program sources. Once the instrument is programmed manually to perform a particular measurement, the program for a remote controller can be read directly from the front panel. Manual operation of the instrument is described by listing thumbwheel switch settings as program words.

3.2 FRONT PANEL CONTROLS

The Model 502 is controlled by a bank of 18 thumbwheel switches grouped into three program words or fields of six characters each, representing the programmable functions, plus a group of non-programmable controls relating tc analog or display functions. Control locations are shown in figure 3-1.

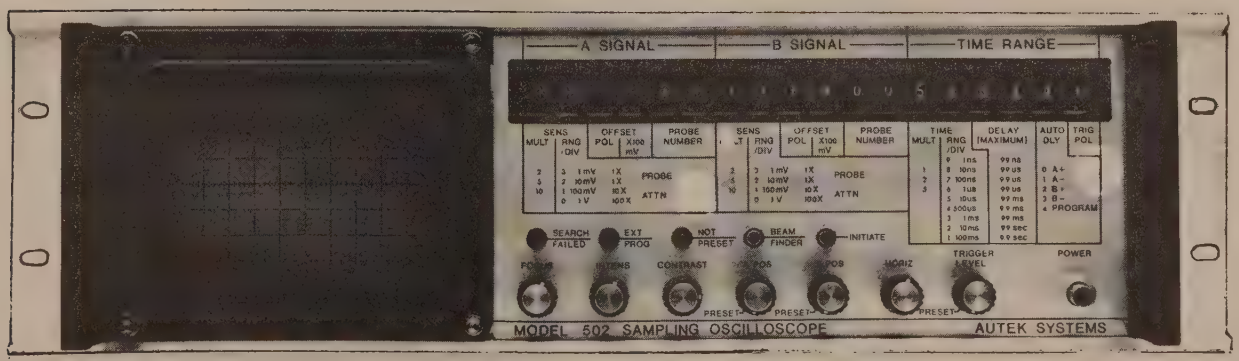


Figure 3-1 Model 502 Front Panel Controls

3.2.1 Manual (non-programmable) Controls

FOCUS	Provides for a sharp trace on the CRT.
INTENS	Knob to adjust the intensity of the CRT display.
CONTRAST	Controls intensity contrast between the base trace and the intensified measurement zone and memory markers. (Functional only when used with the Model 503 Waveform Analyzer.)
A POS B POS	Vernier vertical position (offset) controls for the CRT display, independent for A and B channels and providing for an adjustment range of approximately plus and minus 0.1V (in addition to the programmable offset of ±0.9V). Detented preset positions are provided.
HORIZ	A horizontal position control which allows alignment of the trace with the graticle in making analog measurements; does not affect digital measurements when using the Model 503.
TRIGGER LEVEL	Adjusts sensitivity of the trigger circuit for optimum triggering with low jitter; a preset position is provided for normal triggering.
POWER	Illuminated pushbutton power switch controls power to the instrument.
INITIATE	Momentary pushbutton switch to initiate Auto Delay search; also initiates single measurement when using the Model 503.
BEAM FINDER	Momentary pushbutton switch for finding the CRT beam when it is off screen vertically.
NOT PRESET	A red LED indicator that provides a visual indication to denote some manual control (i.e., A POS, B POS, or TRIGGER LEVEL) is not in Preset position.
EXT PROG	A red LED indicator that provides a visual indication when the instrument is remotely programmed and the thumbwheel controls are disabled.
SEARCH FAILED	A red LED indicator which signals that the Auto Delay search mode has failed to find the required signal for positioning on the CRT. Flashing indicates a repetitive search.

3.2.2 Thumbwheel Switches

The thumbwheel switches provide for manual control of programmable functions. They are grouped into three fields, each containing six digits. These switches are OR'ed with the three program registers for the respective fields. The registers can be remotely programmed by addressing with the appropriate two-character field code - - PA, PB and TR, respectively, for A signal (Probe A), B Signal (Probe B) and Time Range. The field codes are shown in the program word format below, but do not pertain to the thumbwheel switches. The vertical Sensitivity format is shown in table 3-1.

SIGNAL FIELD A

Format: P A X X X X X X

00-99	Remote Probe Number selection when using Multiplexer.
0-9	Offset from 0.0 to 0.9V referred to X1 Probe.
+ or –	Offset Polarity.
0-3	Vertical Sensitivity Range.
2-5-1	For 2X, 5X or 10X Vertical Sensitivity Multipliers.
	Field Code for remote programming.

SIGNAL FIELD B

Format: P B X X X X X X

The programmed functions are similar to those for A Signal, but are independent for the B channel probe. The Time Base format is shown in table 3-2.

TIME RANGE FIELD

Format: T R X X X X X X

+ or –	Trigger polarity.
0 A+ 1 A– 2 B+ 3 B–	Auto Delay Mode, searches for leading edge of pulse of given polarity on specified channel and indexes on CRT.
4	Delay as programmed in 3rd and 4th digits
00-99	Delay program, 0.0 to 9.9 times full scale time for range programmed (1X mult).
1-9	Time Range.
1-2-5	1X, 2X or 5X Multiplier for time Range Time/div.
	Field Code for remote programming.

Table 3-1 Vertical Sensitivity Format

Mult	Range	Atten	Sensitivity	Divisions of Offset
2	3	X1	2 mV/div	± 500
5			5	200
10			10	100
2	2	X1	20 mV/div	50
5			50	20
10			100	10
2	1	X10	0.2V/div	50
5			0.5	20
10			1	10
2	0	X100	2V/div	50
5			5	20
10			10	10

Table 3-2 Time Base Format

Mult	Range	Horizontal Sensitivity	Maximum Delay
1	9	1 ns/div	99 ns
2		2	
5		5	
1	8	10 ns/div	0.99 μs
2		20	
5		50	
1	7	100 ns/div	9.9 μs
2		200	
5		500	
1	6	1 μs/div	99 μs
2		2	
5		5	
1	5	10 μs/div	0.99 ms
2		20	
5		50	
1	4	[illegible]	[illegible]
2		[illegible]	[illegible]
5		500 μs/div	9.9 ms
1	3	1 ms/div	99 ms
2		2	
5		5	

Table 3-2 Time Base Format (Contd)

Mult	Range	Horizontal Sensitivity	Maximum Delay
1	2	10 ms/div	0.99 s
2		20	
5		50	
1	1	100 ms/div	9.9 s
2		200	
5		500	

3.3 REAR PANEL CONNECTORS

All connectors on the Model 502 are located on the rear panel. Figure 3-2 shows the rear panel layout with connector locations and designations. Connector types, designations and functions are given in table 3-3. Functions assigned to each line on jacks J102 through J106 are given in tables 3-3 through 3-8.

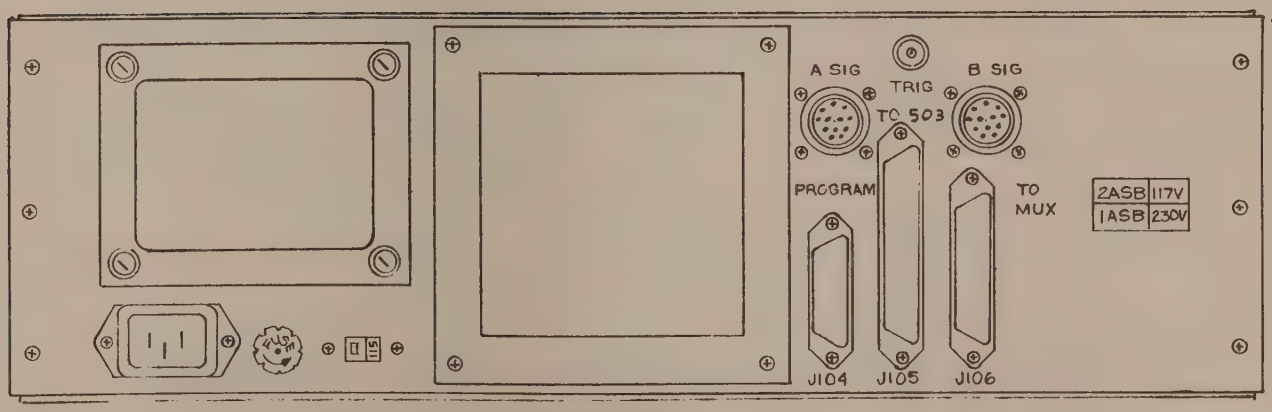


FIGURE 3-2 REAR PANEL CONNECTORS

Table 3-3 Rear Panel Connectors

Designation	Name and Type	Function
J101	Power Cord Receptacle (3-wire type with ground)	Connects the main power line to the instrument (100/115/230V, 50-60 Hz).
F101	Fuse Holder (for AG 3 type)	Main power fuse; 2 ampere Slo-Blo for 115V, 1 ampere Slo-Blo for 230V.
J102	A SIG Probe Connector (Amphenol type 165-12)	Connector for Channel A sampling probe when the Model 502 is operated as a two-channel instrument.
J103	B SIG Probe Connector (Amphenol type 165-12)	Connector for Channel B Sampling probe when the Model 502 is operated as a two-channel instrument.
J104	ASCII Data Buss (24-pin Micro Ribbon)	Program input for external programming using the conventional ASCII code, serial by character, bit-parallel.
J105	Control to 770 (50-pin Micro Ribbon)	Provides all interconnections between the Model 502 and the Model 503 for operation of the 502/503 Waveform Analyzer System.
J106	MUX Control (36-pin Micro Ribbon)	Provides program lines to the MUX for probe no. and sensitivity (attenuator) programming, plus chopper signal and returning signal cables.
J107	TRIG (BNC Jack)	Input connection to the Model 502 trigger circuit. This signal commands the instrument to take a sample. Trigger signal and signal to be measured must be coherent.

Table 3-4 A Signal Probe Connector (J102)

Pin No.	Signal	Connections
A	A Chopper	A9-N
B	-15V	A1-$\overline{F}$
C	+5V	A1-C
D	+15V	A1-A
E	+60V	A1-$\overline{A}$
F	A Sens "1"	A3-16
H	A Sens "2"	A3-17
J	GND	

Table 3-4 A Signal Probe Connector (J102) (Contd)

Pin No.	Signal	Connections
K	A Strobe Coax	A10-J3
L	GND	
M	A Feedback	A3-J2
N	A Error Signal	A3-J1

Table 3-5 B Signal Probe Connector (J103)

Pin No.	Signal	Connections
A	B Chopper	A9-S
B	-15V	A1-$\overline{F}$
C	+5V	A1-C
D	+15V	A1-A
E	+60V	A1-$\overline{A}$
F	B Sens "1"	A4-16
H	B Sens "2"	A4-17
J	GND	
K	B Strobe Coax	A10-J4
L	GND	
M	B Feedback	A4-J2
N	B Error Signal	A4-J1

Table 3-6 Program ASCII Data Buss (J104)

Pin No.	Signal	Connections
1	ASCII #1	B2-2, B
2	ASCII #2	B2-4, D
3	ASCII #3	B2-5, E
4	ASCII #4	B2-6, F
5	– – –	– – –
6	ASCII Clock	B2-9
7	– – –	– – –
8	– – –	– – –
9	– – –	– – –
10	– – –	– – –
11	– – –	– – –
12	Computer Flag	A1-24
13	ASCII #5	B2-7, H
14	ASCII #6	B2-8, J

Table 3-6 Program ASCII Data Buss (J104) (Contd)

Pin No.	Signal	Connections
15	ASCII #7	Not Used
16	ASCII #8	Not Used
17	External Program	S218
18	Program Inhibit	B2-K
19	– – –	– – –
20	– – –	– – –
21	– – –	– – –
22	– – –	– – –
23	– – –	– – –
24	GND	B1-14, R

Table 3-7 Control to Model 503 (J105)

Pin No.	Signal	Connections
1	2 MHz Clock	A6-$\overline{C}$
2	↑ MG (Measurement Gate)	A9-$\overline{E}$
3	↑ MIP (Measurement in Progress)	A9-E
4	AVE 10	A9-$\overline{B}$
5	A Channel Display	A1-H
6	SSI (Start/Stop Interval)	A9-Y
7	Time RNG 1	B5-25
8	Time RNG 2	B5-$\overline{D}$
9	Time RNG 4	B5-26
10	Time RNG 8	B5-$\overline{C}$
11	Time MULT 2	B5-$\overline{F}$
12	Time MULT 5	B5-28
13	PA Sens RNG 1	B3-25
14	PA Sens RNG 2	B3-$\overline{D}$
15	PA Sens MULT 2	B3-$\overline{F}$
16	PA Sens MULT 5	B3-28
17	PB Sens RNG 1	B4-25
18	PB Sens RNG 2	B4-$\overline{D}$
19	PB Sens MULT 2	B4-$\overline{F}$
20	PB Sens MULT 5	B4-28
21	ARM	A1-B
22	FRC (Fast Ramp Clock)	A1-15
23	GNMG	A1-20

Table 3-7 Control to Model 503 (J105) (Contd)

Pin No.	Signal	Connections
24	A SIGNAL	A3-5
25	B SIGNAL	A4-5
26	GND, 2 MHz Shield	A6-R
27	MDM	A6-$\overline{A}$
28	↓ SOR	A7-6
29	GND	A1-R
30	BRIGHT	A1-U
31	SINGLE/CONT.	A1-2
32	SINGLE MEAS.	A1-4
33	ASG	A7-4
34	EMG	A6-Y
35	NOH	A6-W
36	JOG	A6-$\overline{B}$
37	MCC	A6-P
38	A PROG REF.	A9-M
39	B PROG REF.	A9-P
40	SHORT SWEEP	A9-X
41	MG	A9-W
42	↑ RT (Up for Real Time)	A6-25
43	↓ Display Dots	A1-V
44	REF GATE	A9-J
45	NOT PRESET	A1-27 T.P.

Table 3-8 MUX Control (J106)

Pin No.	Signal	Connections
1	Probe A RNG "1"	A3-17
2	Probe A RNG "2"	A3-16
3	A Chopper	A9-N, J102-A
4	A Signal	A3-J3
5	Probe A "1"	B3-1, S206-1
6	Probe A "2"	B3-B, S206-2
7	Probe A "4"	B3-2, S206-4
8	Probe A "8"	B3-A, S206-8
9	Probe B RNG "1"	A4-17
10	Probe B RNG "2"	A4-16
11	B Chopper	A9-S, J103-A

Table 3-8 MUX Control (J106) (Contd)

Pin No.	Signal	Connections
12	B Signal	A4-J3
13	Probe B "1"	B4-1
14	Probe B "2"	B4-B
15	Probe B "4"	B4-2
16	Probe B "8"	B4-A
17	Probe A "10"	B3-4
18	Probe A "20"	B3-E
19	Probe A "40"	B3-5
20	Probe A "80"	B3-D
21		
22	A Signal GND	A3-J3
23	Probe B # "10"	B4-4
24	Probe B # "20"	B4-F
25	Probe B # "40"	B4-5
26	Probe B # "80"	B4-D
27	Mux 7782 (Gnd in MUX)	A3, A4-2
28		
29		
30	B Signal GND	A4-J3
31		
32		
33	Arm	A1-B
34	Inhibit	B2-K
35	Ext. Program	A1-13
36	GND.	B1-R

3.4 INITIAL TURN-ON

The following procedure describes initial operation of the Model 502. For a Calibration check, refer to Chapter 4.

3.4.1 Preliminary

Before the initial turn-on, be sure the instrument is inspected as outlined in Chapter 2. Also, inspect the fuse and marking on the fuse data panel to ensure that the instrument is wired for the correct line voltage.

3.4.2 Equipment Setup

a. The following equipment is required for operating check.

1. Pulse generator with frequency, delay, width and amplitude controls and a trigger output.

2. Two sampling probes, either the Model P20 with 50-ohm termination, the Model P21 with programmable attenuators, or one of each type.

NOTE

The Model 502 should always be used with two sampling probes to properly terminate the sampling circuits.

3. Cables, adaptors,and attenuators as required.

b. Connect the equipment as follows:

1. Model P20 50-ohm sampling probes (assumed) to A and B Channel probe connectors.

2. Pulse generator trigger output to Model 502 trigger input.

3. Pulse generator signal to A channel Model P20 probe.

NOTE

Dynamic range of the Model P20 is ±1V, use a 50-ohm attenuator pad if needed to adjust the signal into the probe to less than one volt.

c. Set the pulse generator as follows:

1. Frequency: 100 kHz, or 10 μs period.

2. Delay: 5 μs.

3. Width: 1 μs.

4. Amplitude: 500 mV approximately.

d. Set the Model 502 controls as follows:

FOCUS: center	A/B POS: preset
INTENS: center	HORIZ: center
CONTRAST: any	TRIG LEVEL: preset
Program: PA12-000	(100 mV/div, 0 offset, probe #00)
PB12-000	
TR16014+	(1 μs/div, 01 μs delay--programmed, + trig)

3.4.3 Locating the Trace

a. Turn on the power for all equipment and allow a brief warm-up period.

b. If no trace appears on the CRT, depress the BEAM FINDER; adjust the TRIG LEVEL control if necessary to secure a sweep.

c. Set the A SIG offset switches and A POS control to center the A trace vertically on the CRT. Since channel B has no input signal, the B trace can be left offscreen to aviod clutter.

d. The A trace should display a 1 μs pulse near mid-sweep; adjust pulse generator amplitude as required for a convenient pulse height.

e. Fine adjust INTENS, FOCUS, HORIZ and TRIG LEVEL controls for a normal sharp, steady display.

f. Switch the input signal cable from probe A to probe B and adjust B channel offset to center the waveform; the display should be the same as for A channel.

3.5 TYPICAL MEASUREMENTS

When the Model 502 is used either alone or in conjunction with the Model 503 Waveform Analyzer, programming for the Model 502 is aimed at placing the waveform of interest on screen with appropriate scale factors. The actual measurement is made either visually from the CRT or digitally by

the Model 503, which processes the analog signal furnished by the Model 502.

3.5.1 Period Measurement

a. Perform the initial turn on and set up given in paragraph 3.4 to display a 1 μs pulse of approximately 10 μs period on one channel:

Pulse Generator: Frequency 100 kHz approx
Delay 5 μs approx
Width 1 μs approx
Amplitude 500 mV approx

Program: PA12-200
PB12-200
TR16004+

b. Adjust the delay program (3rd and 4th digits in the Time Range field) to move the pulse to the left edge of the screen. If the period is slightly less than 10 μs, the leading edge of the second pulse will appear at the right hand edge of the screen.

c. If the period is slightly greater than 10 μs, switch to time range 26 (2 μs/div) and adjust the delay to display two pulses. For greatest accuracy, always make the measurement as near full-screen as possible. Refer to table 3-2 for time base format.

3.5.2 Pulse Width Measurement

a. Program the equipment as given in paragraph 3.5.1a to display a single pulse.

b. Switch to time range 27 (200 ns/div) for greater magnification of the pulse.

c. Adjust Delay in the Time Range field to center the pulse on the screen. The width should be about 5 divisions, and the exact pulse width can be read directly from the CRT.

3.5.3 Rise Time Measurement

a. Start with the display obtained in 3.5.2.

b. Switch to successively faster time bases while adjusting Model 502 and pulse generator delay to keep the signal on screen until the transition is magnified enough to read rise-time.

3.5.4 Propagation Delay Measurement

a. Split the signal with a T-Connector and connect the A-probe to one leg of the T-connector.

b. Insert a length of cable or other device to be tested between the other leg of the T-connector and the B-probe.

c. Adjust the time base and delay to display both A and B signals on the CRT; the propagation delay of the cable can be read as the time between leading edges of the pulses.

3.5.5 Auto Delay

The preceeding measurements required a time-consuming effort through the delay range to find and position the signal on the screen. The Auto Delay mode accomplishes this task for signals which are at least 2 divisions high on the CRT. The 5th digit in the Time Range field can be set to search for the leading edge of either a positive or negative pulse on either A or B channel and position it on the CRT such that the point 2 cm after the beginning of the sweep is approximately 1.5 cm above the baseline. The following examples describe the use of this function:

a. Set the equipment as follows:

Pulse Generator: Frequency 100 kHz approx
Delay 1 μs approx
Width 1 μs approx

Amplitude 500 mV positive
Risetime 1-10 ns
Signal to Probe A

502 Program: PA12-200
PB12-200
TR18000+ (10 ns/div A+ Auto Delay)

b. Press the INITIATE pushbutton on the Model 502. If the pulse was within the search range of the Model 502, the leading edge should have indexed near the left edge of the screen as shown in figure 3-3 (a).

c. If the search for the signal failed due to the pulse being located outside the search range of the Model 502, the SEARCH FAILED light should flash. In this case, reduce the pulse generator delay slowly until the signal is indexed as in figure 3-3 (a) and the light goes off.

d. Switch time range to 100 ns/div (TR17000+) and press INITIATE pushbutton. The signal should index on the CRT as in figure 3-3 (b).

e. Switch to the 1 μs/div time range (TR17000+) and press INITIATE pushbutton The Signal should index as shown in figure 3-3 (c).

f. If the above procedure is continued or the pulse generator delay is adjusted to place the pulse outside the search range, the SEARCH FAILED light will flash. The Model 502 continues to search repeatedly, so that the pulse generator delay can be altered until the search succeeds.

g. Invert the pulse, if the pulse generator has this function, and press INITIATE pushbutton. The search will fail since the Model 502 is searching for a positive pulse.

h. Reset the TIME RANGE field to search for a negative pulse on A channel (i.e., TR17001+) and press INITIATE pushbutton. The Model 502 should find the leading (falling) edge and position it as before.

3.5.6 Overshoot Measurement

a. Set up the equipment as in paragraph 3.5.5a and obtain a display of the leading edge of a pulse.

b. Measure the amplitude of the pulse excluding any overshoot.

c. Switch the vertical sensitivity to successively more sensitive ranges while adjusting offset to maintain a display of the pulse top.

d. At the vertical sensitivity which displays the overshoot with sufficient resolution, measure the height of the pulse overshoot and determine the percentage of the pulse amplitude. The Model 502 has sufficient offset control range to view the top or a 1 volt pulse at a sensitivity of 2 mV/ div. (See figure 3-4).

3.6 REMOTE PROGRAMMING

Remote programming allows the Model 502 to be programmed from an external source such as a computer or a paper tape reader. This is useful for automatic test systems which perform waveform analysis. In a semi-automatic system, the system might pause with a waveform displayed for observation and adjustment. An operator could then continue the test sequence. In a fully automatic waveform analysis system, the Model 503 Waveform Analyzer would be used with the Model 502 to make digital measurements on the waveform. The results of the measurement can be sent to the computer or recorder for comparison with limits for GO–NO GO testing or for developing histograms, etc. In this type of system the measurement is made and data transferred at a rate much too fast for visual observation of the waveform.

Remote program interfacing with the Model 502 is accomplished through the PROGRAM connector, J104, in ASCII code. The ASCII code and interface requirements are detailed below.

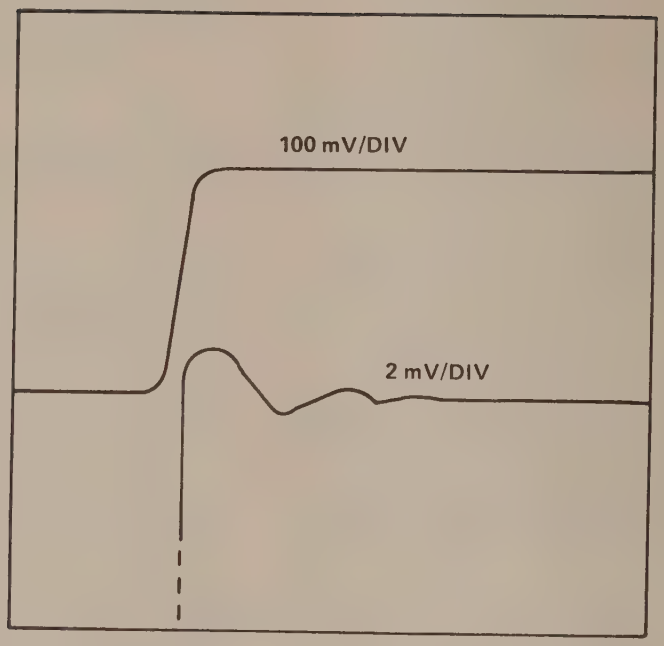


Figure 3-3 Auto Delay Indexing - - Positive Pulse

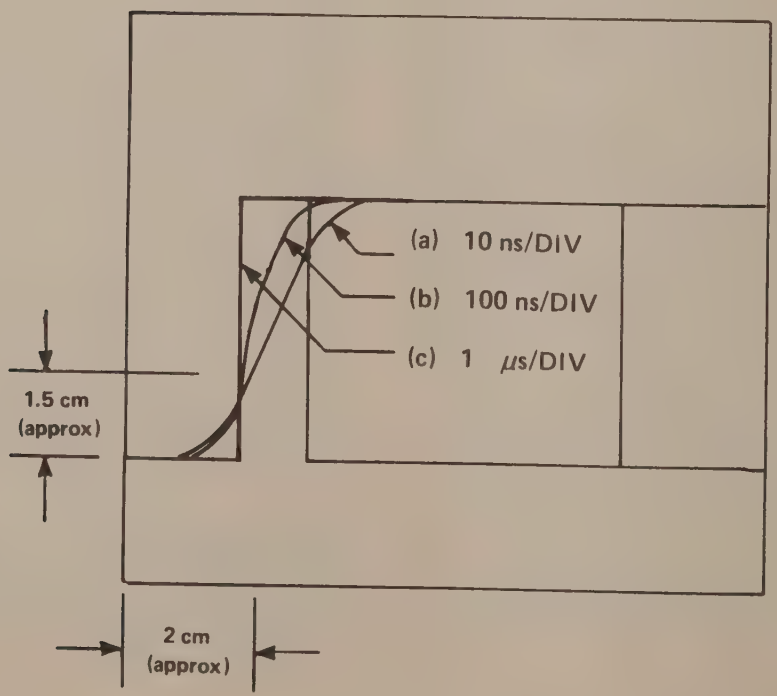
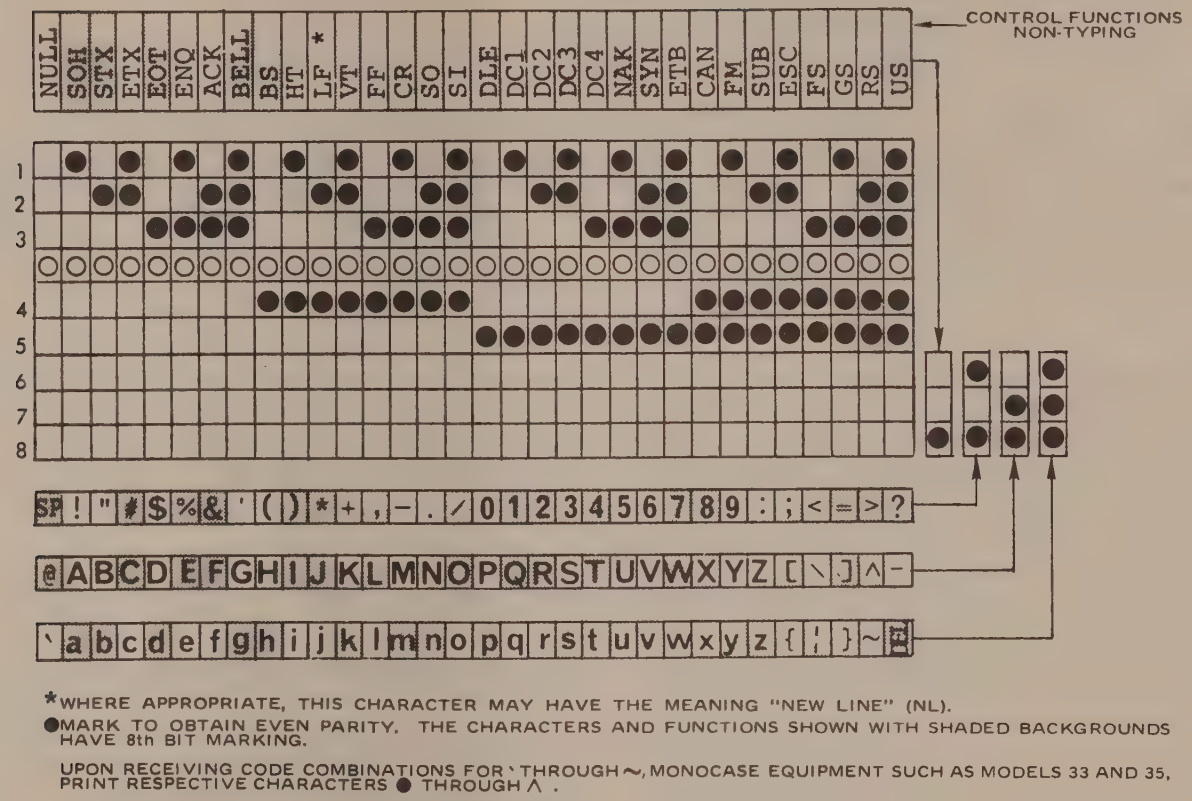


Figure 3-4 Overshoot Measurement

3.6.1 The ASCII Code

Program data to the Model 502 is sent in bit-parallel, serial-by-character format on 6 data lines. ASCII code is used from the program data transmission (American Standard Code for Information Interchange). The ASCII input lines to the Model 502 are TTL low-true. The ASCII code is shown in figure 3-5, in which the dots signify the low or "1" state.


CONTROL FUNCTIONS
NON-TYPING
NULL SOH STX ETX EOT ENQ ACK BELL BS HT LF * VT FF CR SO SI DLE DC1 DC2 DC3 DC4 NAK SYN ETB CAN FM SUB ESC FS GS RS US
1 2 3 4 5 6 7 8
SP ! " # $ % & ' ( ) * + , - . / 0 1 2 3 4 5 6 7 8 9 : ; < = > ?
@ A B C D E F G H I J K L M N O P Q R S T U V W X Y Z [\ ] ^ -
` a b c d e f g h i j k l m n o p q r s t u v w x y z { | } ~ DEL

*WHERE APPROPRIATE, THIS CHARACTER MAY HAVE THE MEANING "NEW LINE" (NL).

●MARK TO OBTAIN EVEN PARITY. THE CHARACTERS AND FUNCTIONS SHOWN WITH SHADED BACKGROUNDS HAVE 8th BIT MARKING.

UPON RECEIVING CODE COMBINATIONS FOR ` THROUGH ~, MONOCASE EQUIPMENT SUCH AS MODELS 33 AND 35, PRINT RESPECTIVE CHARACTERS ● THROUGH ^ .

Figure 3-5 ASCII Code Chart

3.6.2 Program ASCII Data Buss (J104)

Remote programming from an ASCII source is applied to J104 on 6 data lines in bit-parallel, serial-by-character format. An additional line is used for the ASCII clock, which must occur within the "clean" region of the data bits in case there is contact bounce. The minimum ASCII clock width is 1.5 microseconds.

Table 3-6 details the pin connections for J104. All the lines are TTL low-true, with 0 to +0.4V representing the low or "1" state and +2.4 to +5.0V representing the high or "0" state. Each data line presents a fan-out of 4 to 7 TTL loads; i.e., the data source must be capable of sinking up to 11 mA in the low state.

The External Program line, pin 17 of J104, must be held in the low state for remote programming. In this state the thumbwheel switches are disabled. When this line is high for manual programming, the Model 502program registers retain the last program entered from a remote source, and the instrument reverts to this program when pin 17 is again grounded. The EXT PROG light on the front panel indicates the state of this line. In either state the registers may be externally programmed registers as a program source.

3.6.3 Program Format

Programmable functions of the Model 502 are controlled by three program registers, each containing a field of 6 characters. Each of these fields controls a related group of functions - - A Signal, B Signal and Time Range. In addition, each register has an address or field code consisting of two alpha-characters. The three program register addresses or field codes are PA, PB, and TR, respectively, for Probe A, Probe B and Time Range. The Model 502will also decode the field code GO, which serves the same functions as the manual INITIATE pushbutton. A program word to control any of the three fields consists of the two-character field code followed by the 6 characters of desired program data.

For example, letting the actual program data be represented by X's, a complete program for the Model 502 would be as shown below.

```
PAXXXXXX
PBXXXXXX
TRXXXXXX
GO
```

The program data format for each word or field is identical to that given for the thumbwheel switches in paragraph 3.2.2. In fact, by addressing the program registers with the appropriate field codes, a program manually set by the thumbwheel switches can be remotely entered by copying the settings on the switch banks.

Any program word (or an entire program) is entered without spaces or punctuation. The words may be programmed in any sequence, provided that each field code is followed by 6 characters of valid program data. Any field may be edited by reentering the complete word with desired corrections.

3.6.4 Program Inhibit

The Model 502 Program Inhibit line (J106-pin 34 and J104-pin 18) can be grounded (TTL low state) to inhibit the Program Decoder from responding to the ASCII Data Buss when desired. This line presents a fan-out of six TTL loads.

As previously noted the External Program line (J104-17) can be used to select the program source, front panel thumbwheel switches or remotely-programmed registers. In either case, the Model 502 continually monitors the ASCII Program Data Buss and loads the registers when they are addressed with the proper field codes. In an automatic test system any number of instruments may be connected to the ASCII Data Buss. As long as each instrument responds to different field codes and no other traffic occurs on the buss, such as when two identical instruments are to be programmed, it is necessary to prevent some or all instruments from responding to extraneous data. The Program Inhibit line provides this function in the Model 502.

3.6.5 Computer Interface Lines

Inputs and outputs used in interfacing the Model 502 with a computer are listed in table 3-9.

Table 3-9 Computer Interface Lines

Connector	Signal	TTL LOADS (Drive)	Comment
J104-17 &J106-35	External Program		Input to control program source; High for local, low for remote.
J105-3	Measurement-In-Progress	(1)	High output while a measurement is in progress; without the Model 503 MIP is always high.
J105-28	Search Over-Range	(1)	Low output when Auto Delay Search fails to find signal.
J105-32	Single Measurement	(2)	Input in parallel with INITIATE pushbutton, accepts single MEAS command from Model 503; can be driven by computer instead of GO command.
J106-34 &J104-18	Program Inhibit	(6)	Control input, low to inhibit 502 Field Decoder from monitoring Program ASCII Data Buss.
J105-45	Not Preset	(10)	Low output flags computer that some control, A POS, B POS or TRIG LEVEL, is not in detented preset position.
J104-12	Computer Flag	(2)	Fast measurement command - can be driven by a computer in lieu of a GO command; TTL low-true.

CHAPTER 4

MAINTENANCE AND CALIBRATION

4.1 INTRODUCTION

This chapter contains procedures for adjustment and calibration of the Model 502. Also, trouble-shooting and repair information is provided to aid the user on maintaining the instrument in proper operating condition. Whenever an Autek Systems instrument requires service, the nearest representative should be contacted. He can provide field service, or arrange factory returns, when necessary. Address all inquiries on operation or application to your nearest sales representatives; or, Sales Manager:

AUTEK SYSTEMS CORPORATION

3200 Coronado Drive
Santa Clara, CA 95051
(408) 496-0400

Specify both model and complete serial number in all correspondence.

4.2 ASSEMBLY DESIGNATIONS

Table 4-1 lists, for reference purposes, information concerning the P.C. board assemblies used in this model.

Table 4-1 Model 774 Assembly Cross-Reference Information

Assy No.	Nomenclature	Part No.	Schematic No.
A1	Display Logic	625-049	625-049
A2	Extender	625-036	- - -
A3, 4	A/B Preamplifier	625-051	625-051
A5	Auto Delay	625-048	625-048
A6	Slow Ramp	625-045	625-045
A7	Delay Logic	625-046	625-046
A8	Clock	625-047	625-047
A9	Control Logic	625-054	625-054
A10	Fast Ramp	625-052	625-052
B1	X-Y Amplifier	625-044	625-044
B2	Field Decoder/Sequencer	625-053-2	625-053-2
B3	Prog. Register (PA)	625-023	625-023
B4	Prog. Register (PB)	625-023	625-023
B5	Prog. Register (TR)	625-023	625-023
B6	Power Supply	625-013-2	625-013-2
C1/S201-S217	Diode Bd/Sw	625-031	625-031

Table 4-1 Model 502 Assembly
Cross-Reference Information (Contd)

Assy No.	Nomenclature	Part No.	Schematic No.
C2/S218	Buss Control Bd/Sw	625-027	625-027
D1	Rectifier Board	625-037	625-037
D2	H.V. Power Supply	625-043	625-043

4.3 ASSEMBLY AND CONNECTOR PIN LOCATIONS

A top view of the Model 502 is shown in figure 4-1, indicating the locations of assemblies, chassis parts and connectors. Throughout the tests in this chapter, assemblies are referred to in abbreviated form. For example, a connection to A7 Pin 9 is indicated as A7-9.

4.4 TEST EQUIPMENT

Table 4-2 lists the minimum test equipment inventory capable of supporting the maintenance of this instrument. In the event these specific items are not available, units of equal or greater accuracy and capability may be substituted.

The calibration procedures in this manual contain references to the digital readout on the Model 503 Waveform Analyzer, which is assumed to be used as a companion instrument. If the Model 503 is not used, it will be necessary to make analog measurements from the CRT display. In this case the lower accuracy specification of the analog display will apply.

Table 4-2 Test Equipment Required

Nomenclature	Characteristics	Recommended Type
Waveform Analyzer	For Digital Measurements using Model	Autek Model 503
Time Mark Generator	5 ns to 1s Time Std.	Tek Type 184
Calibration Fixture	Pulse Voltage Std.	Tek Type 067-0508-00
Oscilloscope	Plug-In Type	HP Model 180A
Vertical Plug-In	50 MHz, Dual Trace	HP Model 1801A
Time Base Plug-In	Time Base to 100 ns/div	HP Model 1821A
10:1 Oscilloscope Probe	10:1, 10 pF, 10 mΩ	HP Model 10004A
Digital Voltmeter	0.1% accuracy for up to 150 Vdc	Autek Model P21
Volt-Ohmmeter	Ohms Scales for up to 1 Ohm DC Volts for up to 3 kV	Triplet Model 630-NA
Pulse Generator	±10V in 5 ns, width to 10 ms, triggerable	S-D Model 101
Sampling Probe	50 Ohm, 350 ps Rise	Autek Model P20
Sampling Probe	Hi-Z, Programmable	Autek Model P21

C301
C304
C303
C302
F301
CR
305
R
301
Q303
Q301
Q302
Q304
Q305
B6
B5
B4
B3
B2
B1
FAN
CAUTION
HIGH
VOLTAGE
D2

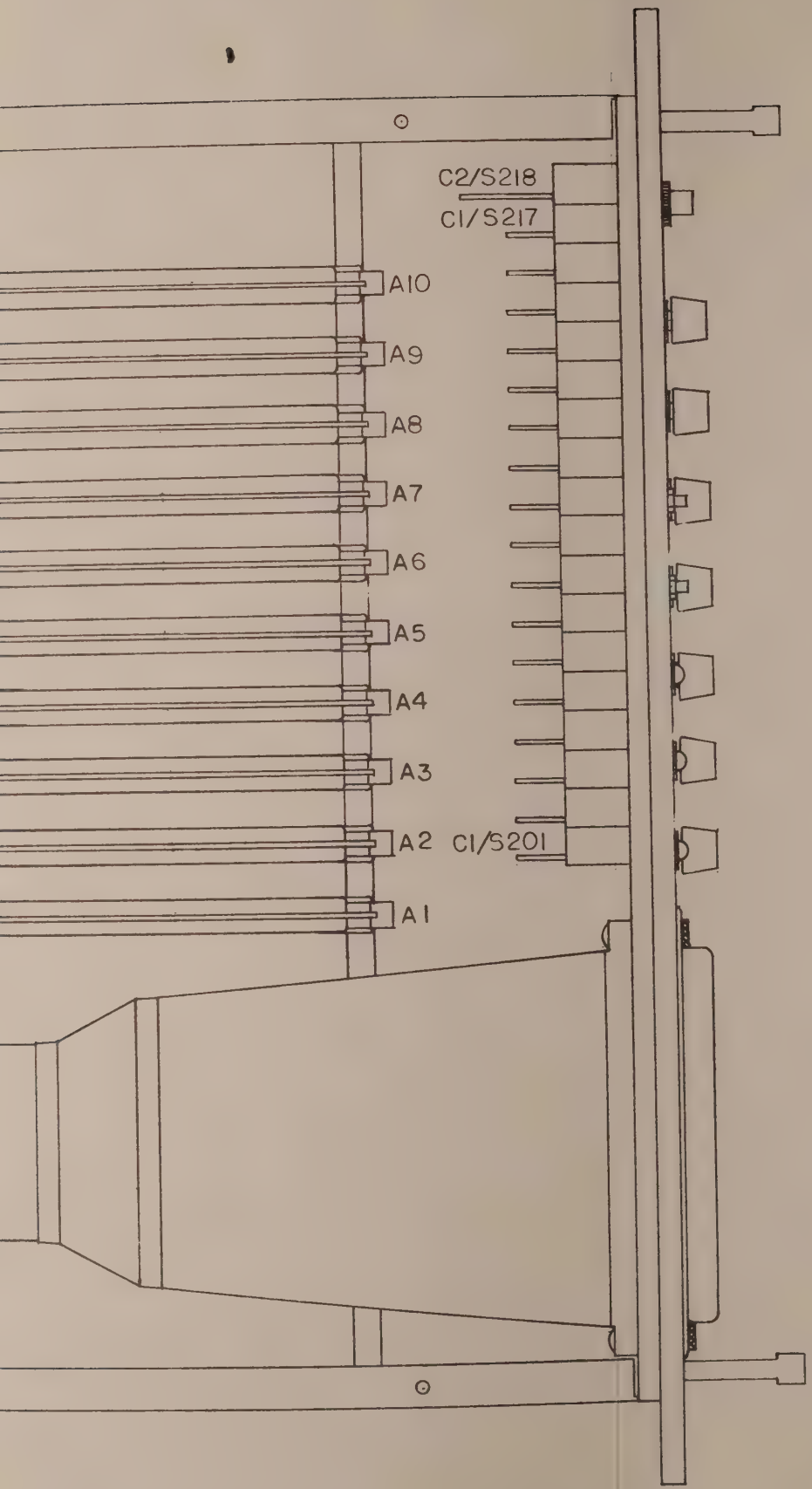


FIGURE 4-1
MODEL 502 TOP VIEW

Table 4-2 Test Equipment Required (Contd)

Nomenclature	Characteristics	Recommended Type
Signal Pickoff	10% into 50 Ohms	Tek Type CT-3
Cables and Adapters	Various BNC, GR-874	
Attenuator pad	50-ohm X5, X10	Tek Types 017-044, 017-046

4.5 IN-CABINET PERFORMANCE CHECK

The in-cabinet performance check can be used as an operational checkout of the instrument. It might also find useage for incoming inspection, as a plan to locate defective parts, and for routine calibration checks.

The performance tests apply to the Model 502 when used without the Model 503 Waveform Analyzer. When the Model 503 is used, the more complete in-cabinet performance check given in the Model 502/503 manual should be followed.

Programming of the instrument during functional performance tests may be obtained from any of the normal program sources; i.e., thumbwheel switches, ASCII keyboard, paper tape reader or computer. However, since the program word format is the same regardless of the source, thumbwheel switch settings are given as program words to provide a convenient means of describing the test conditions.

When the instrument is used with a Model 180 182 Sampler Multiplexer, the operation is the same as when the Model 502 is used with just two probes. It is necessary, however, to alter the A Signal and B Signal program words given in this chapter to incorporate the actual numbers of the probes used during the tests. When no MUX is used the probe number programming is not functional and these program words may be shortened.

4.5.1 Vertical Sensitivity

a. Connect the Calibration fixture to the Model 502 as shown in figure 4-2(a), using the A Signal probe. The Cal Fixture must be terminated with an accurate 50 ohm resistor for this test.

b. Set the equipment as follows:

Calibration Fixture: 600 mV Square Wave

Model 774 Program: PA12+300
PB12+300
TR56004+
(Adjust manual controls as required).

c. The square wave displayed on the CRT should be 6 cm high within the accuracy specifications. For digital readout using the Model 503, refer to Chapter 4 of the Model 502/503 Waveform Analyzer System Manual.

d. Reset the equipment for successively more sensitive ranges as indicated in table 4-3 and check for 6 cm of vertical deflection. It will be necessary to adjust the A POS control to keep the waveform centered on screen.

e. Repeat steps a through d using Probe B.

Table 4-3 Vertical Sensitivity Check

Cal Fixture Sq Wave	Model 502 A Sig Program	Model 502 Vertical Sensitivity	CRT Vertical Deflection
600 mV	PA12+300	100 mV/div	6 cm
300 mV	PA52+200	50 mV/div	6 cm
120 mV	PA22+100	20 mV/div	6 cm
60 mV	PA13+000	10 mV/div	6 cm
30 mV	PA53+000	5 mV/div	6 cm
12 mV	PA23+000	2 mV/div	6 cm

4.5.2 Noise

a. Using the equipment setup of figure 4-2(a), unplug both probes after ensuring that the Model 502 is properly triggered. Be sure that each of the Model P20 probes has a 50-ohm adapter attached.

b. Program the Model 502 as follows:

PA23+000
PB23+000
TR56004+
A POS and B POS adjusted to bring traces on screen.

c. Noise on each trace should be less than 1 mV (90% of dots).

4.5.3 Offset

This paragraph presents a functional check of the programmable offset circuit in the Model 502. Since the offset is intended merely to bring waveforms on screen for observation, high accuracy of offset steps is not intended; however, the steps should typically be within 5% accuracy.

a. Connect the Model 101 pulse generator to the Model 502 as shown in figure 4-3 and connect Probe A to the positive signal output through a X10, 50-ohm attenuator.

b. Set the equipment as follows:

Pulse Generator: Frequency 100 kHz approx
Delay 5 μs, approx
Width 2 μs, approx
Amplitude 5V, approx

Model 502 Controls: PA12-000
PB12-000
TR26004+
A/B POS Preset

c. Two or three positive pulses should be observed on the CRT, and the baseline should be approximately at the center or 1 cm above the center of the CRT. This position is affected by adjustments in both the sampling probe and in the offset circuit in the Model 502.

d. Vary the A POS control through its range; the baseline should be adjustable approximately ±100 mV (1 cm at 100 mV/div) from the preset position.

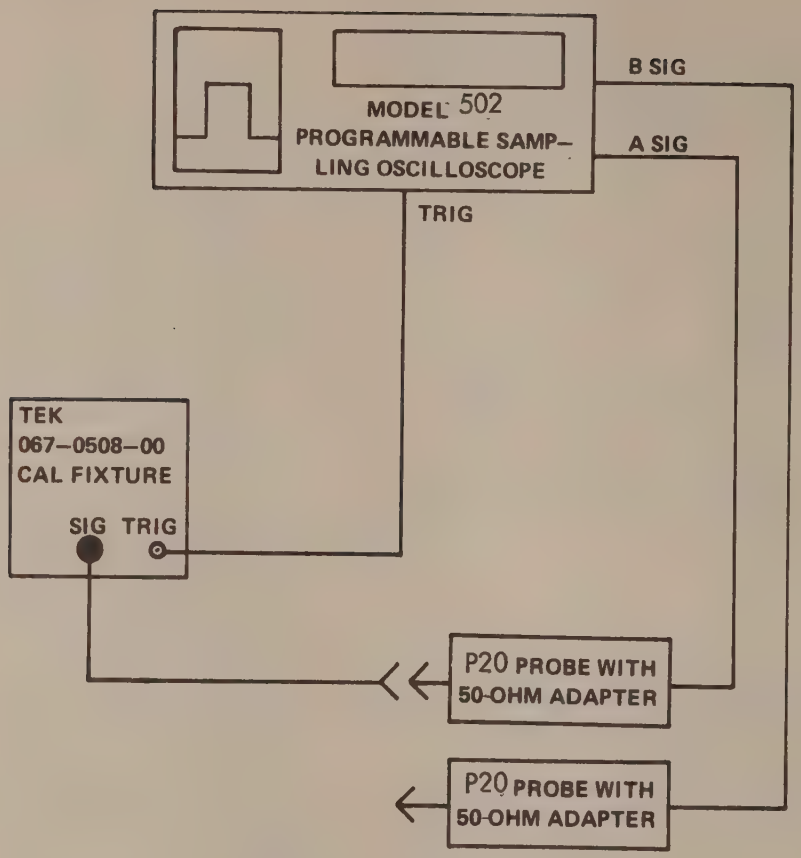
e. Increase the Probe A offset through each step from -0 to -9 and note whether the A trace responds approximately 100 mV/step. Increase pulse amplitude as required to keep the pulse top of screen.

f. Set the pulse amplitude to +1 volt into the probe and set the Probe A vertical sensitivity to 2 mV/div with -9 offset; i.e., set PA23-900. It should be possible to adjust the A POS control to observe the pulse top on this range.

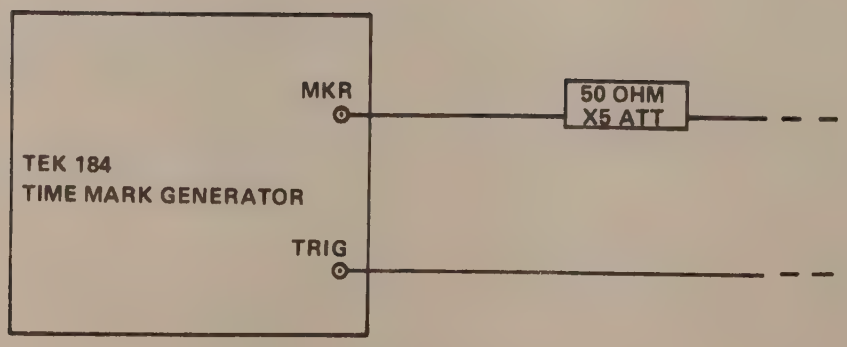
g. Set the Probe A controls to PA23-000 (2 mV/div, -0 offset) and adjust the A POS control to center the baseline on the CRT. Change the offset to +0 and note the baseline shift, which should be not more than 1 cm.

h. Connect Probe A to the negative signal output from the pulse generator and repeat steps a through f above, and program positive offset rather than negative offset.

i. Repeat steps a through h above for Probe B.



(a) Vertical Sensitivity Tests



(b) Time Base Tests

Figure 4-2 Equipment Setup For In-Cabinet Performance Check

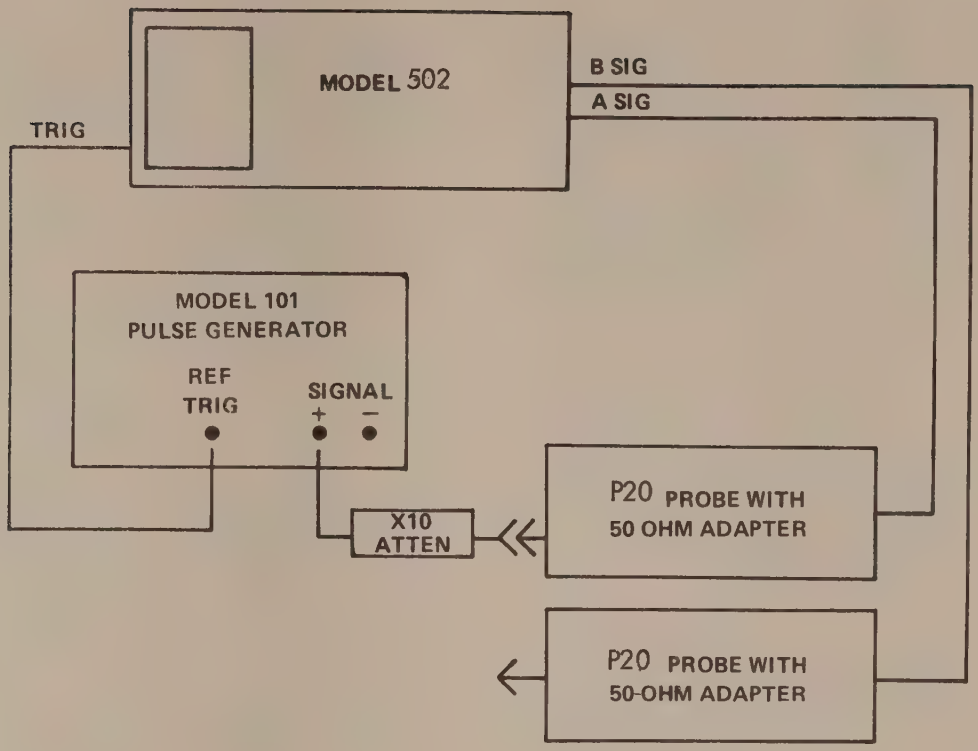


Figure 4-3 Offset and Delay In-Cabinet Performance Test Setup

4.5.4 Trigger Level

a. Connect the time mark generator to the Model 502 as shown in figure 4-2(b).

b. Set the equipment as shown below:

Time Mark Generator: Marker Selector to 1 μs.
Trigger Selector to 1 μs.
Marker Ampl to OFF
HF Selector to OFF

Model 502 Program: PA12-300
PB12-300
TR57004+
(Adjust manual controls as required.)

c. Rotate the Model 502 TRIG LEVEL control fully CCW but not into the detented preset position. The instrument should not be triggered.

d. Slowly advance the TRIG LEVEL control CW until the instrument triggers. It should be possible to obtain a very stable display without noticeable jitter.

e. Disconnect the trigger input cable to the Model 502 and advance the TRIG LEVEL control to the fully clockwise position. The trigger circuit should free-run, indicated by an incoherent CRT display.

f. Turn the TRIG LEVEL control fully CCW and set into the detented preset position. With no trigger input the trigger circuit should not free-run.

g. Connect the trigger cable to the Model 502 The instrument should be triggered in the preset position.

h. Switch to another trigger rate and observe whether trigger is stable. At higher frequencies it might be necessary to manually adjust the TRIG LEVEL control for optimum tirggering unless a standardized trigger signal is used.

NOTE

When signal and trigger frequencies are independently controlled, as with the time mark generator, a false display will be obtained when the trigger rate is greater than the signal rate.

i. Switch the marker selector to 10 ns and remove the attenuator from the line. Use a 10:1 trigger pickoff to derive a trigger for the Model 502 from the signal being observed to eliminate any jetter between the signal and the marker.

j. Adjust the TRIG LEVEL control for optimum triggering of the Model 502 on time range 29 (2 ns/div). It should be possible to obtain a stable display with this trigger level (approx. 50 mV at 100 MHz).

4.5.5 Time Base

This paragraph provides a time base calibration check using a time mark generator as a standard. This procedure is given without the use of the Model 503 digital readout. When the Model 503 is used, the in-cabinet performance check given in Chapter 4 of the Model 502/503 manual should be followed.

The time mark generator used in this section derives the higher output frequencies by multiplying the frequency of a crystal oscillator, while the trigger output is counted down. The output for these ranges is sinusoidal with some decay over the fundamental period, and jitter might be excessive when the trigger output is used. Therefore, a trigger pickoff should be used to derive a trigger signal from the signal being observed on all ranges for which the time mark generator output is sinusoidal.

a. Connect the time mark generator to the Model 502 as shown in figure 4-2(b). Set the equipment as follows:

Time Mark Generator:	Marker Selector to 5 μs. Trigger Selector to 10 μs. Marker Ampl to OFF HF Selector to OFF
Model 502 program:	PA12-300 PB12-300 TR56004+ (Adjust manual control as required).

b. Adjust the HORIZ POS control to center the trace on the CRT. The sweep amplitude should be exactly 10 cm; any error here will affect the following tests.

c. Check the CRT for a marker spacing of 1 marker/cm.

d. Switch the Model 502 time multiplier to 2 (range 26) for a time base of 2 μs/div and check the display for markers 2.5 cm apart.

e. Switch the Marker Selector to 1 μs and the Model 502 time base to 1 μs/div (range 16) and check for 1 marker/cm.

f. Using table 4-4 as a guide, test all other time ranges. On ranges 5 through 9 it is unnecessary to repeat the test for the 1 and 2 multipliers. On ranges 1 through 4 (real-time sampling ranges) the narrow marker might not be wide enough for reliable observation. Therefore, externally trigger a pulse generator (such as the Model 101) with the time mark generator and observe the pulse generator output with the Model 502. A convenient pulse width can be set for each time range.

Table 4-4 Time Base Check

184 Marker Selector	184 Trigger Selector	Model 502 Time Range	Model 502 Time/div
10 ns	1 μs	59	5 ns
0.1 μs	1 μs	58	50 ns
1 μs	1 μs	57	500 ns
1 μs	10 μs	16	1 μs
5 μs	10 μs	26	2 μs
5 μs	10 μs	56	5 μs
50 μs	100 μs	55	50 μs
0.5 ms	1 ms	54	500 μs
1 ms	1 ms	13	1 ms
5 ms	10 ms	23	2 ms
10 ms	10 ms	53	5 ms
10 ms	10 ms	12	10 ms
50 ms	0.1 s	22	20 ms
0.1 s	0.1 s	52	50 ms
0.1 s	0.1 s	11	0.1 s
0.5 s	1 s	21	0.2 s
1 s	1 s	51	0.5 s

4.5.6 Delay

The following is a functional test of the programmable delay circuit in the Model 502 Accuracy of delay is related to accuracy of the time base and not separately adjustable. Table 3-2 provides a useful guide for this test.

a. Connect equipment, using the Model 101 pulse generator, as shown in figure 4-3 and set the controls as follows:

Pulse Generator: Frequency 10 kHz, approx.
Delay 10 μs, approx
Width 1 μs, approx
Amplitude +0.5V into the Model 7701 Probe.

502 Controls: PA12-300
TR16004+

b. Adjust the pulse generator delay to place one edge of the observed pulse at the right-hand edge of the CRT. Step the Model 502 delay units digit from 0 through 9 and observe that the signal moves to the left 1 μs/step.

c. Return the delay units digit to 0 and step the tens digit from 0 through 9. The signal will move the full width of the CRT for each step, and it is necessary to readjust the pulse generator delay each time.

d. In the above tests using the "1" multiplier (time range 16), the range of programmable delay is 10 (i.e., 9.9) screen diameters. Referring to table 3-2, note that the full-scale delay is constant for each range without regard to the multiplier. This would represent 5 screen diameters when using the "2" multiplier, or 2 diameters when using the "5" multiplier.

e. A separate test is required for the real-time sampling ranges, ranges 1 through 4. Set the equipment as follows:

Pulse Generator: Frequency 100 Hz, approx.
Delay 10 ms, approx.
Width 1 ms, approx.
Amplitude 0.5V, approx

502 Program: PA12-300
TR13004+

f. Adjust the pulse generator delay to position the pulse at the right hand edge of the screen and exercise both the units and tens digits of delay as given in steps b and c.

4.5.7 Auto Delay

The Auto Delay search range is the same as the range for programmed delay, but auto delay has three digits of resolution. As for programmed delay, a separate test is required for the rear-time sampling ranges (ranges 1 through 4). Only two tests are required, since changing the time base has no effect on the functioning of auto delay except for the change over between real time and sampling. Indexing of a positive pulse in the auto delay mode is illustrated in figure 3-3. The amplitude of the pulse must be at least 2 cm on the CRT.

When the Model 502 is used alone, an auto delay search is initiated. In the event of a search overrange, the SEARCH FAILED light will illuminate and flash as the auto delay circuit repeatedly searches for the pulse.

a. Set up the equipment, using the Model 101 pulse generator, as shown in figure 4-3, and set the controls as follows:

Pulse Generator: Frequency 50 kHz, approx.
Delay 5 μs, approx.
Width 1 μs, approx.
Amplitude +0.5V into probe.

502 Program: PA12-300
TR16004+

b. Adjust the pulse generator delay to move the pulse slightly off-screen to the right.

c. Set the time range controls to TR16000+ and press the INITIATE pushbutton. The Model 502 will search for the leading edge of the positive pulse on Channel A and position it approximately 2 cm from the left edge of the screen as shown in figure 3-3(c).

d. Move the pulse by means of the pulse generator delay controls. Pressing the INITIATE button should cause the pulse to be positioned as before.

e. Change the time range to 5 μs/div (TR56000+) and initiate a search. Increase pulse generator delay and re-initiate, repeating this procedure until the SEARCH FAILED light illuminates. The pulse is now outside the search range of the Model 502 and the light should flash as the auto delay circuit repeatedly searches for the pulse.

f. Decrease pulse generator delay slowly while observing the CRT. When the pulse is within the search range of the auto delay circuit, the pulse should be found and positioned on the CRT as before without re-initiation.

g. A search for a negative pulse on Channel A can be initiated by programming TR56001+. When a negative pulse is then applied to Probe A, the circuit will function as described in step f. However, the leading edge which is positioned on the CRT now has a negative slope.

h. Test the auto delay function similarly on any real-time sampling range (ranges 1 through 4). Note that the delay is in real time, so that adequate time should be allowed for the search when using time range 1.

i. The tests given in steps a through h apply to Channel B, however, since the same circuits are involved and Channel B tests are unnecessary.

4.6 TROUBLESHOOTING PROCEDURES

4.6.1 Instrument Fails to Operate

a. If the instrument is completely inoperative, ensure that line power is available.

b. Check main power fuse F101, +5V fuse F301 (on the power supply chassis), and power switch S224, for continuity after disconnecting the power cord.

c. Check line voltage connections to be certain that they are correct for the available line voltage. (Refer to paragraph 2.3.)

d. Be certain that power supplies are properly energized, and that each output meets the specifications.

e. Check to see that sampling probes are connected to the instrument.

4.6.2 Instrument Performs Incorrectly

a. Check whether the instrument is being operated in accordance with procedures given in Chapter 3. In particular, note the initial turn-on procedures.

b. Refer to functional block diagram figure 5-1, and coaxial cabling diagram figure 5-4, and isolate the fault to a particular assembly. Not Note the following suggestions.

1. All power supplies must be correct in accordance with paragraph 4.11 for proper operation.

CAUTION

When a power supply is faulty, do not operate the instrument until the problem is corrected.

2. Isolate the instrument from any multiplexers which might be used, and check whether the instrument operates correctly as a two-probe unit.

3. When applicable, disconnect the Model 503 to determine whether the Model 502 operates properly as a single unit.

4. Problems in the serial program section, B2 through B5, can be isolated by programming locally through the thumbwheel switches (except integrated circuits IC9 through IC14 on the Program Registers).

5. Problems in the thumbwheel switch assemblies might be isolated by programming remotely through an ASCII keyboard or other ASCII sources. An exception would be the Buss Control Board assembly, C2/S218.

6. Various signals into and out of Control Logic assembly A9 can help determine where in the measurement cycle the instrument is malfunctioning. This will aid in isolating the fault to a particular assembly.

4.6.3 Probing Sequence to Secure a Trace

Using a 50 MHz oscilloscope with a high impedance probe (refer to table 4-2), the following procedure provides information to ensure that the instrument is operating sufficiently to secure a trace on the CRT.

a. The instrument must be triggered, check for 0.5V trigger amplitude at D4 on A10.

b. The fast ramp must run up on all but real-time sampling ranges; check for a positive ramp from a pedestal of approximately 1V at A10-R20. The ramp should reset when it reaches maximum level without pausing.

c. The RTC (Real-Time Clock) must be present on A10-4 on all real-time sampling ranges.

d. The fast ramp comparator must operate and produce an FRC; check for a low-going TTL-level FRC of approximately 1 μs width on A10-F.

e. Check RTS (Real Time Sync) on A10-Y, which should be a low-going TTL pulse of

approximately 200 ns width occuring on alternate input triggers.

f. The Slow Ramp must operate to produce a sweep. Check A10-J2 for a positive-going ramp of 1, 2 or 5V amplitude, respectively, for the 1, 2 or 5 time range multipliers. This ramp starts from DC level dependent on delay program, between approximately 1V and 11V.

g. The ZAD (Z Axis Drive) signal must exist to display a dot, therefore, check A1-T for a positive-going TTL-level signal of approximately 2.5 μs width occuring at the FRC rate.

h. If a sweep exists but there is no vertical signal, check whether the Strobe blocking oscillator is operating. A positive spike approximately 12V amplitude is greater than 200 ns width should appear at the cathode of D5 on A10.

i. Check whether the stretch gate is operating on A3 and A4. The anode of D8 should show a pulse of about 0.5 μs width, dropping to ground from a quiescent level of about +12.5V, and occuring at the FRC rate.

j. When a multiplexer is used, the stretch gate is in the MUX and the sampled signal reaches A3 and A4 through J3.

k. Sampled signal outputs should exist at A3-E and A4-E. If not, check the preamplifiers to the sampling probes.

l. Follow the sampled signals through the A/B Signal Chopper (A1-M) to the vertical deflection plate drive at the collectors of Q1 and Q2 of the X-Y Amplifier, B1. The mean potential on these collectors is approximately 70V.

m. If circuits up to this point are functional there is no display, check High Voltage Supply Assembly D2.

WARNING

Extremely high voltages appear on this board, and every precaution should be taken against shock hazard.

1. A ZAD signal ranging from ground to approximately +40V should exist on the collector of Q5.

2. A near-sinusoidal oscillation should appear at the collector of Q3, swinging from near +10V to approximately +40V (approximately 50 kHz).

3. Approximately -1750V to -2000V should appear on the cathode of the CRT.

WARNING

To protect personnel and the HV Supply, do not probe the cathode circuit with a voltmeter having lower than 100 megohms input resistance. To protect the CRT, do not place probe on the CRT grid circuit.

4. Use the X1 scale of an ohmmeter to check components: Q1, Q2, Q3, D1, D2, D3, and D5. D4 cannot be successfully tested with an ohmmeter; replace the diode if operation is doubtful.

4.7 INSTRUMENT COVER REMOVAL

To remove either the top or bottom cover, remove the four exposed flush-mounted screws and lift the cover away. Always disconnect the power cord first.

4.8 ASSEMBLY LOCATION

Modular assemblies and major components are shown in figure 4-1. Note that the "A" PC Board Assemblies are located in the front row, and the

"B" assemblies are in the back row, both with the component side facing away from the CRT. The "C" assemblies are located on the front panel, and the "D" assemblies are located on the rear and side panels.

4.9 PRINTED CIRCUIT BOARD REMOVAL

a. PCB assemblies A1 through B7 are removed by lifting directly upward. Coaxial cables, if any, can be removed after removing the board. Always turn off power before removing or replacing a board. Align the board with its socket carefully before replacing.

b. Rectifier Board D1 and HV Supply D2 must be unbolted for removal.

c. Diode Board C1 and Buss Control C2 should be left as part of Switch Assemblies S201 through S218. This thumbwheel switch assembly can be removed only as a single unit.

4.10 PRINTED CIRCUIT BOARD REPAIR

When replacing integrated circuits or other electronic components soldered to PC boards, the procedures indicated below should be followed to avoid possible damage to the board components.

1. Determine by troubleshooting techniques which integrated circuits or discrete components have failed.

2. Remove the defective components from the board by cutting the pins or leads with a small diagonal clipping tool. (Always remove and replace the entire component).

3. Apply heat (40W-50W soldering iron) sparingly to each of the cut pins or leads and remove from the board. Clean the holes with a toothpick or solder suction tool.

4. Form the leads of the replacement part and insert into the PCB holes, solder, then trim leads to extend 1/16 inch beyond the back of the board. (Use 60-40 or 63-47 solder with flux core and a diameter of 1/32 inch).

CAUTION

Always trim semiconductor leads only after soldered installation is complete. This procedure greatly lessens the possibility of component failure due to shock-wave damage caused by the trimming tool. Be especially careful to use a minimum of heat when soldering tunnel diodes or diodes in miniature glass packages (snap varactor and schottky diodes in the Model 502).

5. When soldering semiconductor devices and all small components, be sure to use a heat sink tool or long-nosed pliers connected to the component lead(s) while each is being soldered. Allow the soldered connection to cool before removing the heat sink.

6. Clean all dirt and flux from the PCB by liberal application of cool tricholrethylene or freon solvent with a brush. Do not use alcohol.

WARNING

Use solvents only in a well-ventilated area, avoid contact with the skin, and avoid breathing the vapors.

4.11 CALIBRATION PROCEDURE

Calibration adjustments should be made in the order given, because some adjustments depend upon the preceeding ones. No adjustment should be made, however, unless a problem has been found or a symptom noted which indicates the need for calibration. All voltages are referred to the signal ground on the board in question unless otherwise noted. Power voltages are referred to the power busses on the card cage.

4.11.1 Power Supply Adjustment (B6)

Note that the +150V supply is used as a reference and contains the only adjustment. The -15V, +5V and +15V supplies use the +150V as a reference and will track when it is adjusted. The -1V supply is obtained from the -15V supply through an emitter follower, and is located on the power supply chassis.

a. Adjust the power supply without using the extender. A short tuning tool (insulated screwdriver) will be needed. Measure voltages on the Card Cage Power Busses.

b. Turn on the power and allow a few minutes for warm-up.

c. Connect the digital voltmeter between B6-R (Ground) and B6-$\overline{D}$ (+150V). Be certain that the DVM range is selected to measure 150 VDC.

d. Adjust R11 (5K potentiometer) for +150 (±0.1)V.

e. Check B6-A for +15V (±1%).

f. Check B6-$\overline{F}$ for -15V (±1%).

g. Check B6-C for +5V (±5%).

h. Check the -1V supply (emitter of Q304) for -0.5 to -1.1V.

4.11.2 H.V. Power Supply Adjustment (D2)

The H.V. Adjustment potentiometer, R7, is the only adjustment on this board. The CRT cathode voltage is adjusted, using an oscilloscope probe or a voltmeter with at least 90 Megohms input resistance and capable of reading -2000 VDC. To protect the CRT, do not place probe in grid circuit.

WARNING

Extremely high voltages appear in this assembly which are hazardous to presonnel. Do not make or break voltmeter connections while power is on.

a. Turn off power to the Model 502 and allow capacitors to discharge.

b. Remove the protective shield from Assembly D2.

c. Make a secure ground connection from the meter to the D2 assembly and connect the high voltage probe to the junction of diode D3 and R11.

d. Set voltmeter scale to read -2000 VDC.

e. Turn on power to the Model 502 and note cathode voltage reading. Keep hands clear of voltmeter leads.

f. Adjust R7 as required to adjust cathode from between -1750 and -2000 VDC.

g. Turn off power and allow capacitors to discharge.

h. Remove voltmeter leads and securely replace the protective shield over D2.

4.11.3 Display Adjustment (A1)

Trace rotation and astigmatizm adjustments are located on this board. These controls will not normally require adjustment unless the CRT has been changed or the HV supply adjusted. It does not matter whether or not the Model 503 is used with the 502.

a. Trace Rotation

1. Free-run the Model 502 trigger and terminate the sampling probe to obtain a trace on the 100 mV/div range; e.g., PA12XXXX, TR57004+.
2. Turn down the instensity and adjust the focus for a sharp, fine trace; center the trace on the screen.
3. With no input signal, adjust the trace rotation potentiometer, R15 to align the trace with the graticle. Use either channel. Operate S1 if necessary to obtain the adjustment.

b. Astigmatism Adjustment

1. Connect the Model 502 to a signal source and obtain a sweep on any convenient time range. Move one channel off screen and set the signal generator so that the Model 502 displays a signal of about 1/2 to full-screen on the 100 mV/div range. Use sinusoidal source with many cycles for a convenient display.

2. Adjust INTENS for normal viewing intensity.

3. Adjust FOCUS for optimum sharpness.

4. Adjust Astigmatism potentiometer R19 for minimum dot size. Continually readjust FOCUS while adjusting R19.

4.11.4 X-Y Amplifier Adjustment (B1)

The X and Y deflection gain adjustments are located on this board. These adjustments affect the CRT display only, and the procedure given depends on using a calibrated voltage source without reference to the Model 503. Alternatively, any source of rectangular pulses may be used and the X and Y adjustments are made to bring the CRT display into agreement with digital readout on the Model 503.

a. Use a 50-ohm probe on channel A and connect the Model 502 to Cal Fixture as shown in figure 4-2(a).

b. Set the equipment as follows:

CAL FIXTURE: 600 mV Square Wave

774 PROGRAM: PA12+300 (100 mV/div)
TR560044
(Adjust Manual Controls as required).

c. Obtain a square wave centered on screen and allow time for the equipment to warm up.

d. Adjust R11 for exactly 6 cm of vertical deflection.

e. Adjust R13 for exactly 10 cm of sweep width.

4.11.5 Offset Zero Adjustment (A3 & A4)

The position zero potentiometer is adjusted so that zero signal level at the preamplifier input is displayed at center screen when the POS control is preset. If the probe bridge has previously been balanced, the potentiometer is simply adjusted. However, the procedure given eliminates that requirement. No input signal is needed. The procedure is for A channel (A3); and the procedure is repeated for B channel (A4). Both adjustments should be exactly the same.

a. Turn off the power and place A3 on an extender.

b. Ground pin A3-2 on the extender using a clip lead to energize K7.

c. Remove the coaxial cable from J3; ground J3 using a clip lead.

d. Turn on the equipment and allow time for warmup.

e. Set the Model 502 controls as follows:

PA23+000 (2 mV/div, zero offset)
TR16XXXX (any convenient time range)
A POS: Preset
TRIG LEVEL: Free-run, or triggered from any source of trigger pulses.

f. Adjust A3R33 to center the A trace on the CRT.

g. Turn off the power, remove the ground clips, replace the cable on J3, and replace A3 without the extender.

h. Repeat steps for B channel, using A4 on the extender.

4.11.6 Time Base Calibration (A10)

Time base calibration adjustments for sampling ranges (5 through 9) are located on this board. The time base for real time range (1-4) is crystal-controlled and not adjustable. The procedure given depends on use of the Model 503 for digital readout. It is necessary that the Model 503 be in calibration before proceeding. The time base should not be calibrated by reading the CRT display except when the Model 503 is to be used without the Model 503.

a. Connect the Model 502 to the time mark generator as shown in figure 4-2, and use A channel.

b. Turn power off on the Model 502 and place A10 on an extender.

c. Turn the power on and allow a warm-up period.

d. Set the time mark generator as follows:

Marker Selector:	50 μs
Trigger Selector:	0.1 ms
Marker Amplifier:	OFF
H.F. Selector:	OFF

e. Program the Model 502/503 as follows:

PA52-100
PBXXXXXX
TR55504+
MOT10
MA01P99P
MBXXXXXX
ST50%A2+
SP50%A8+
CONT MEAS
(Adjust manual controls as required).

f. adjust R31 for a Model 503 DRO of 300 μs.

g. Refer to table 4-5 and similarly adjust time ranges 6 through 9.

h. When using the 20 ns marker it is not possible to read 6 time periods - note the ST/SP conditions in table 4-5. If jitter presents a problem when using the 20 ns marker, use a 1: 0 trigger pickoff and trigger the Model 502 from the signal being observed.

i. Turn off the Model 502 power and replace A10 in the card cage.

Table 4-5 Time Base Calibration

184 Marker Selector	184 Trigger Selector	Model 502 Time Range	A10 Adj.	Model 503 ST	Model 503 SP	Model 503 DRO (SEC)
50 μs	0.1 ms	55	R31	50%A2+	50%A8+	30.0 E-5
5 μs	10 μs	56	R29	50%A2+	50%A8+	30.0 E-6
0.5 μs	1 μs	57	R27	50%A2+	50%A8+	30.0 E-7
50 ns	1 μs	58	R25	50%A2+	50%A8+	30.0 E-8
20 ns	1 μs	59	R23	50%A1+	50%A2+	20.0 E-9

4.11.7 Minimum Delay Adjustment (A6)

Minimum delay is set by adjusting the slow ramp offset (with zero delay programmed) to minimize the delay between the Model 502 trigger pulse and the first sample in the sweep. When this adjustment is properly made, the beginning of the sweep will index very slosely on ranges 5 through 9. This adjustment has no effect on real-time ranges 1 through 4. The time base must first be accurately calibrated. The adjustment is critical. When the slow ramp offset is set too low, approximately the first cm of sweep will be uncalibrated. If set too high, however, the effect is the same as when some delay is programmed and the ranges will not index at the start of the sweep.

a. Using Probe A, connect the Model 502 to a pulse generator with variable delay as shown in figure 4-3.

b. Set the equipment as follows:

Pulse Generator:	Frequency 100 kHz approx. Delay 2 μs approx Width 5 μs approx Amplitude approx. 0.5V into probe.
502 Program:	PA12-200 TR56004+ (Adjust manual controls as required).

c. Adjust pulse generator delay to position the leading edge of the pulse at the left edge of the screen.

d. Switch the Model 502 to time range 58 and note whether the leading edge of the pulse still indexes at the left edge of the screen. Adjust A6R10 if necessary to index the pulse.

e. Return to range 56 and reset pulse generator delay to index the pulse,

f. Switch back to range 58 and readjust R10 if required.

g. Once the adjustment is made, index the pulse on range 59 and check ranges 58, 57, 56 and 55. The left edge of the screen should index from range to range within 2% of full scale +50 ns.

h. Remove the input signal from the probe and terminate the probe with 50 ohms.

i. Switch to a vertical sensitivity of 2 mV/div (PA23-000) and adjust A POS to place the trace on screen.

j. Check ranges 55 through 19 in succession, noting whether a notch or vertical deflection appears on the trace at the start of the sweep. If so the minimum delay adjustment is set too low and must be backed off until the trace is flat.

CHAPTER 5
OPERATIONAL DESCRIPTION, DRAWINGS, PARTS AND WIRE LISTS

5.1 INTRODUCTION

This chapter contains an operational description at the block diagram level, drawings, parts and wire lists for the standard instrument.

5.2 PRINCIPLES OF OPERATION

The Model 502 is a programmable, two-channel sampling oscilloscope for observing waveforms at signal repetiotion rates from a fraction of a Hertz up to 500 MHz. This instrument is especially designed for use with the companion Model 503 Waveform Analyzer to form an automatic digital waveform analyzer system. These two units are operated as a single instrument, all necessary interconnec - tions between them being made by means of a single control cable. Measurement ca pa-bilities of this system include signal voltage, period, rise time (between percentage points on the waveform or between programmed voltage thresholds), pulsewidth, and propagation delay. The Model 502 uses two remote sampling probes, one for each channel. A selection of probe type allows choice of fast rise time (350 ps) or great dynamic range (2 mV to 10 V/division) with built-in chopper and programmable attenuators.

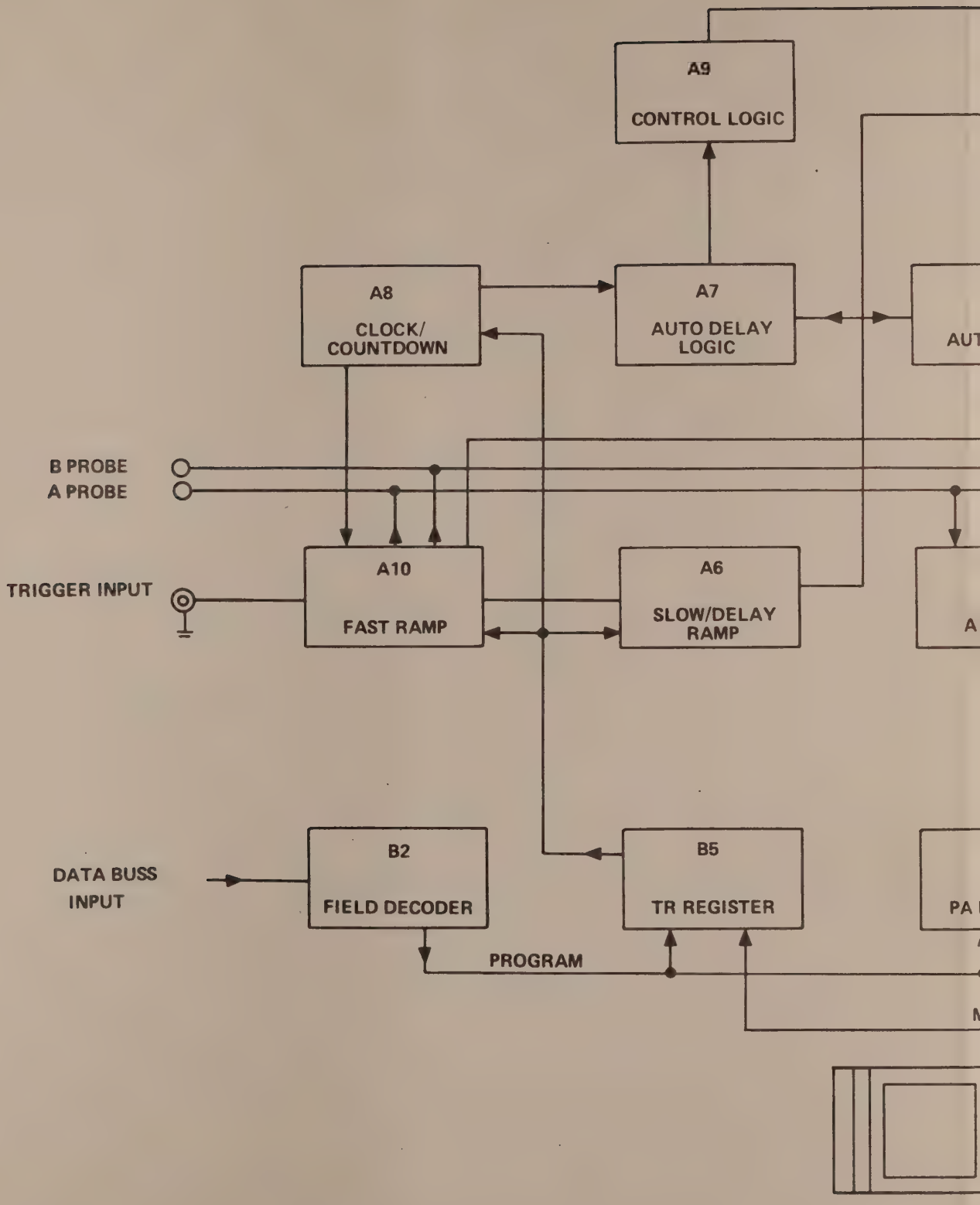
Figure 5-1 is a functional block diagram of the instrument, each block representing a printed circuit board assembly. Maintenance is simplified by the division of circuitry to include, in general, a complete function on each board.

The program selection of a field decoder/sequencer and three program registers which latch the program data. The field decoder/sequencer recognizes the program word mnemonics (PA, PB, TR, and GO) in the bit-parallel, character-serial ASCII input and enables the appropriate program register. The field decoder/sequencer also sequentially gates the ASCII clock so that the following six characters are sequenced into the appropriate BCD latches in the addressed register. The output gates in the program registers "OR" the program stored in the registers with the front panel thumbwheel controls. Local or remote programming is selected by means of the External Program line in J104.

5.3 CIRCUIT REFERENCE DESIGNATORS

All printed circuit assemblies in the instrument are letter designated. The "A" series is located in the front card cage, the "B" series in the rear card cage, the "C" series is on the front panel, and the "D" assembly is on the rear panel. Circuit reference designators start from 1 on each assembly and progress through the number of components of the respective type used on that assembly. For example, assembly A1 shows components R1, C1, Q1, etc., while this same series is repeated on assemblies A3, A4 and so on. In addition, component designators in the 100 series signify components located on the rear panel, while the 200 series is on the front panel and the 300 series is located on the chassis.

Within the parts lists, the local reference designator is used rather than full reference designation. For example, in the A3 assembly J1 is referred to rather than A3J1. Occasionally, where clarity demands it, the complete reference designation is used.


A9
CONTROL LOGIC
A8
CLOCK/
COUNTDOWN
A7
AUTO DELAY
LOGIC
AUT
B PROBE
A PROBE
TRIGGER INPUT
A10
FAST RAMP
A6
SLOW/DELAY
RAMP
A
DATA BUSS
INPUT
B2
FIELD DECODER
B5
TR REGISTER
PA
PROGRAM

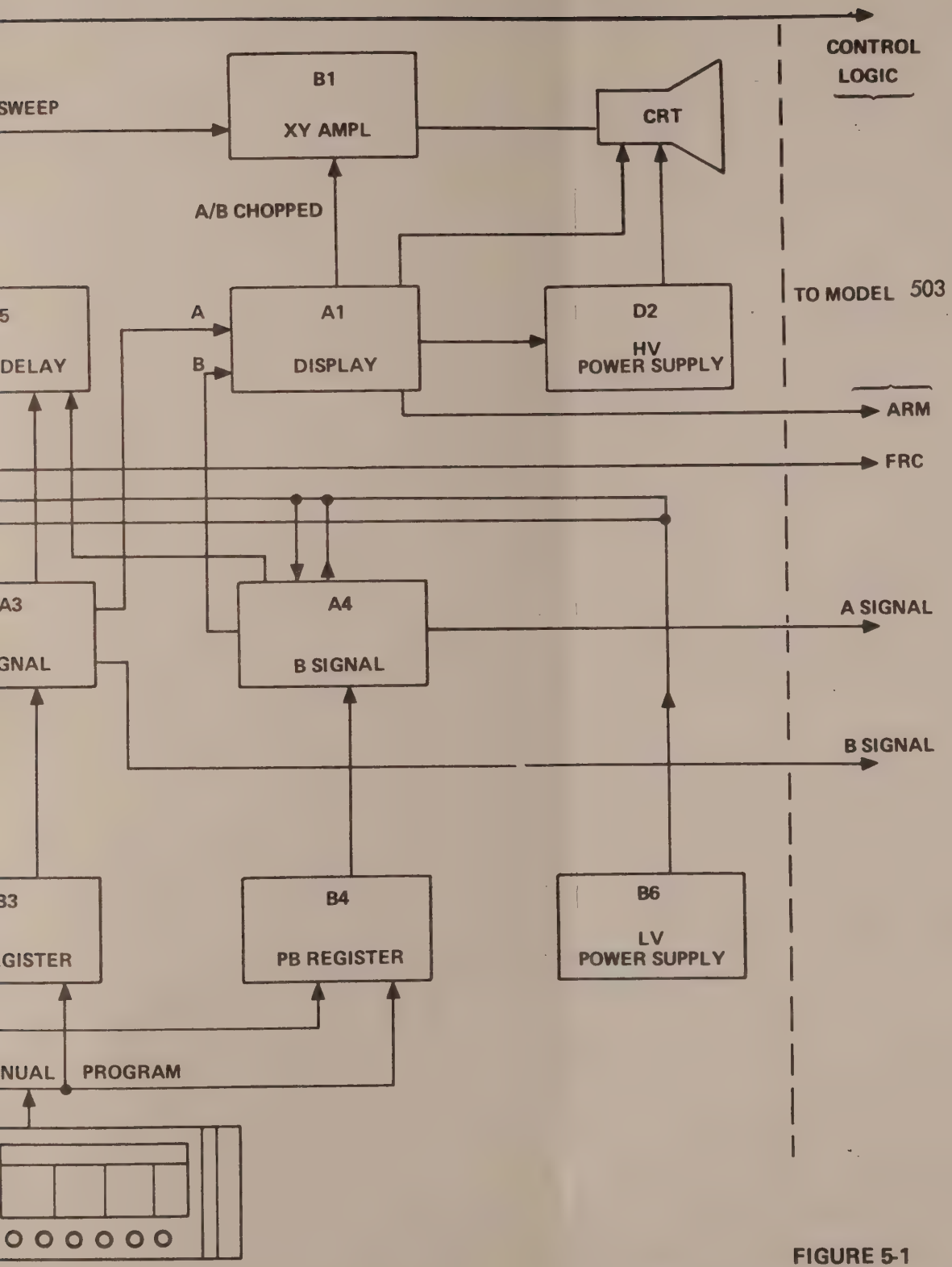
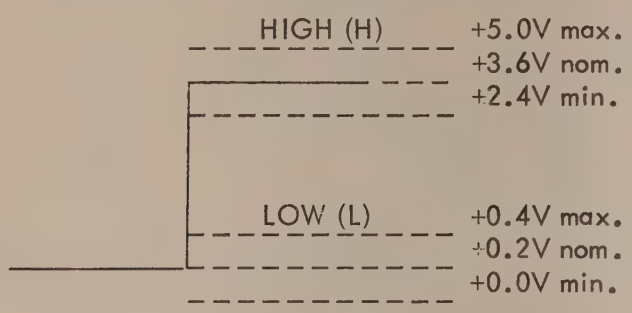


FIGURE 5-1

MODEL 502 FUNCTIONAL BLOCK DIAGRAM

5.4 LOGIC SYMBOLS AND NOTATION

Most integrated circuit modules used in this instrument are DTL/TTL compatible, and signal levels are 0.0 to 0.4 V for the low (L) state and +2.4 to +5.0 V for the high (H) state. Figure 5-2 depitcts these definitions.



DTL/TTL LEVELS

Figure 5-2 Logic Level Definitions

Figure 5-3 shows the most common symbols used in this manual to represent the Logic Functions. The truth tables and Boolean expressions define the logic functions in terms of high and low status. A small circle at the output of the symbol indicates that the output terminal is low when the input logic levels have been satisfied.

In Figure 5-3 the active state of a logic line may be identified with the inclusion or absence of a bar over the signal name. For example, $\overline{\text{RESET}}$ indicates a low-level signal producing the active condition of reset. In the remainder of the manual, however, the barred notation indicates nothing more than inversion (complementation) of the signal existing at some other point. For clarity, a waveform is often drawn on the schematic, or the critical state may be denoted by arrows pointing up or down to indicate high or low state, respectively, to activate the indicated function.

5.5 LOGIC DEVICES

Table 5-1 lists the typical integrated circuit devices found in this instrument.

5.6 MANUCATURER'S INDEX

The parts lists provide ordering data for replacement parts. Standard devices, such as transistors, are listed by the 2NXXXX number without naming a particular manufacturer. Selected or manufactured components are listed by the six-digit part number

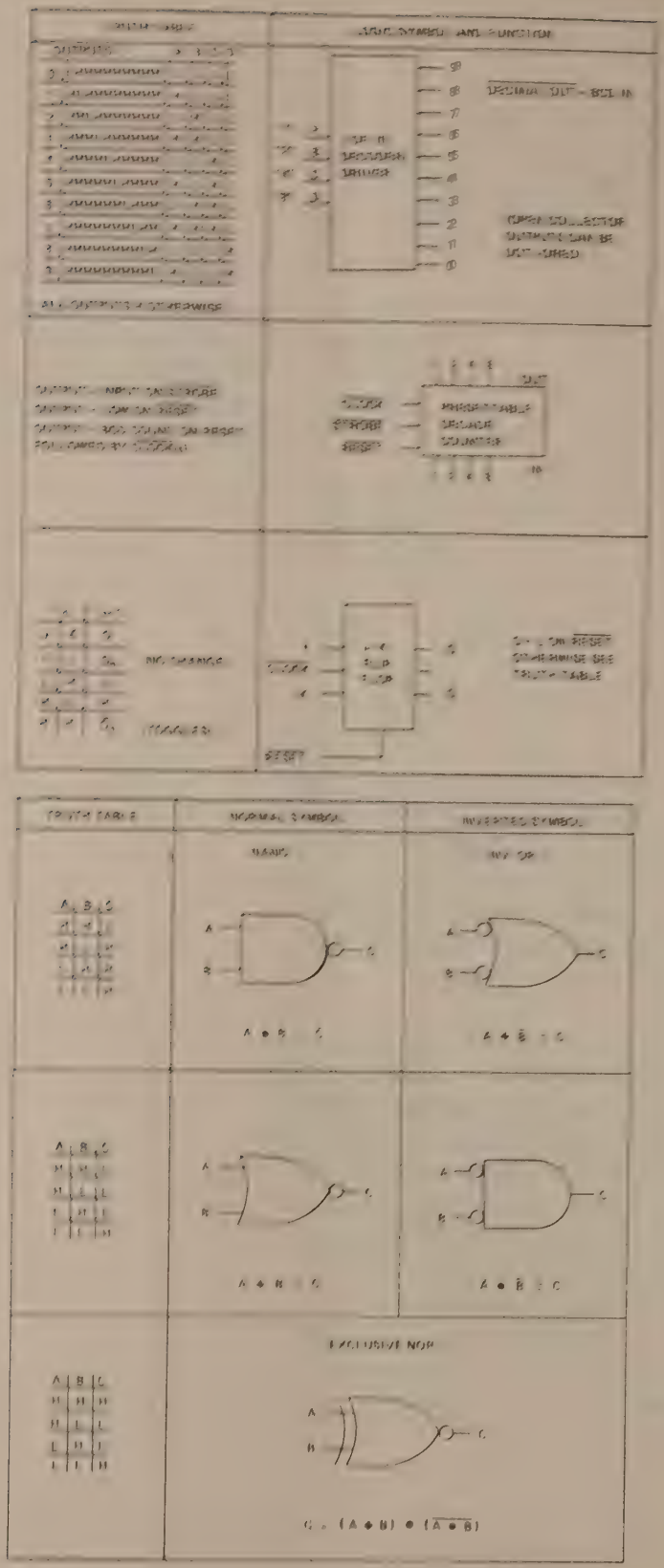


FIGURE 5-3 LOGIC FUNCTION SYMBOLS

Table 5-1 Typical I.C. Components in Model 502

Part No.	Description	Motorola	Signetics	National
170-946	DTL Quad 2-input NAND	MC946P		
171-114	Dual TTL Comparator	MC1414P		
171-700	TTL Quad 2-input NAND	MC7400P		MD7400N
171-703	TTL Quad 2-input NAND, Open Collector	MC7403P		
171-704	TTL Hex Inverter	MC7404P		
171-708	TTL Quad 2-input AND	MC7408P		
171-710	TTL Triple 3-input NAND	MC7410P		
171-720	TTL Dual 4-input NAND	MC7420P		
171-726	TTL Quad 2-input NAND, 15 Volt Open Collector	MC7426P		
171-730	TTL 8-input NAND	MC7430P		
171-746	TTL 1 of 10 Decoder/ Driver, Open Collector	MC74145P		
171-773	TTL Dual J-K Flip-Flop	MC7473P		
171-833	TTL Quad 2-input Multiplexer		N8233B	
171-842	TTL Quad 2-input EXNOR, Open Collector	MC7242P	N8242A	
171-880	TTL Decade Counter		N8280A	DM74176N
178-456	Operational Amplifier, Internally Compensated	MC1456CG		

5.7 COAXIAL CABLING

Many of the board-to-board and board-to-panel connections in this instrument are made by means of miniature coaxial cables to preserve the bandwidth or integrity of the signals. Figure 5-4 depicts all coaxial cable connections for the instrument. Each assembly is shown pictorially, so that the jack locations are obvious at a glance. Only one loose inter-board cable is used (i.e., not tied into a harness).

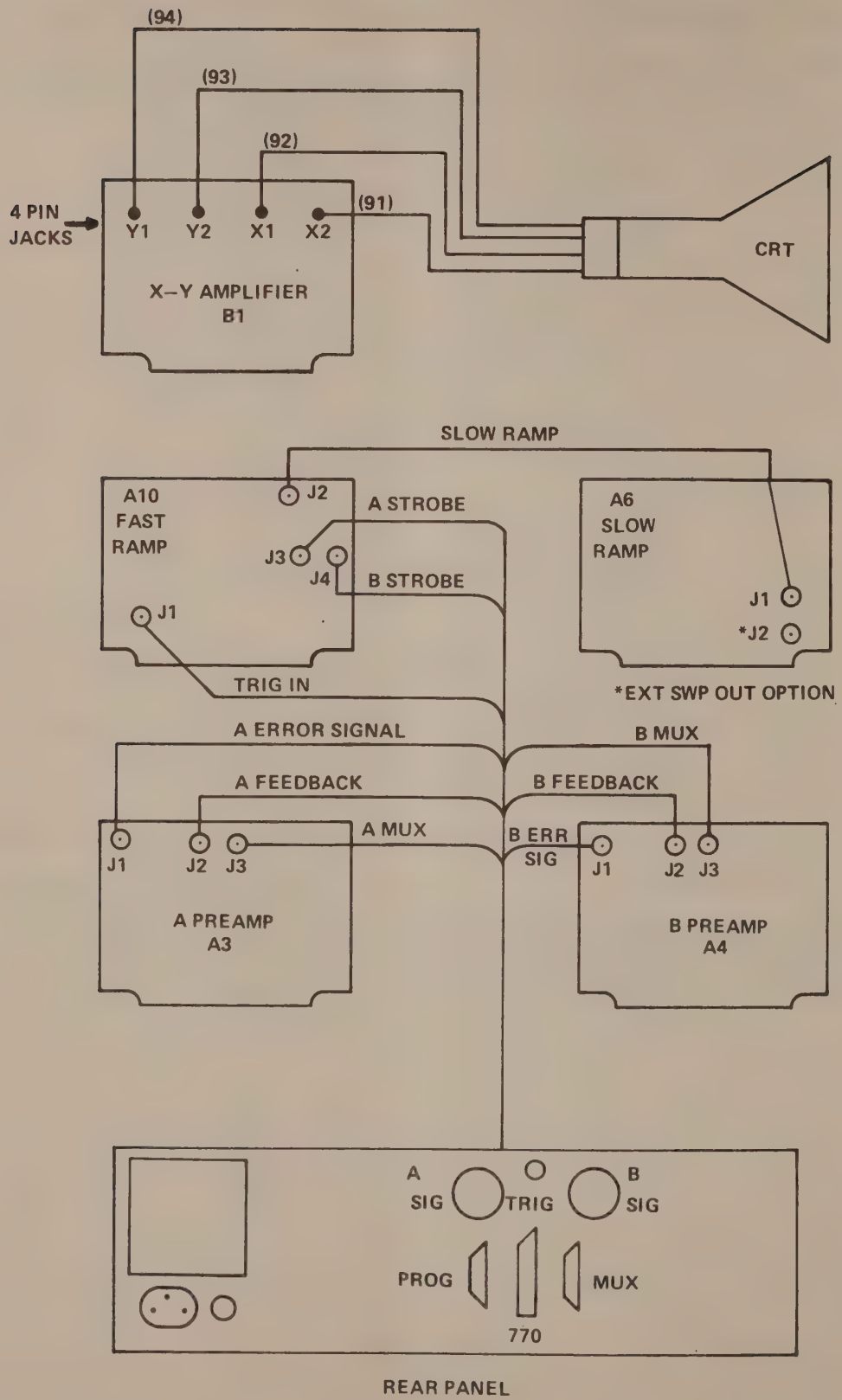
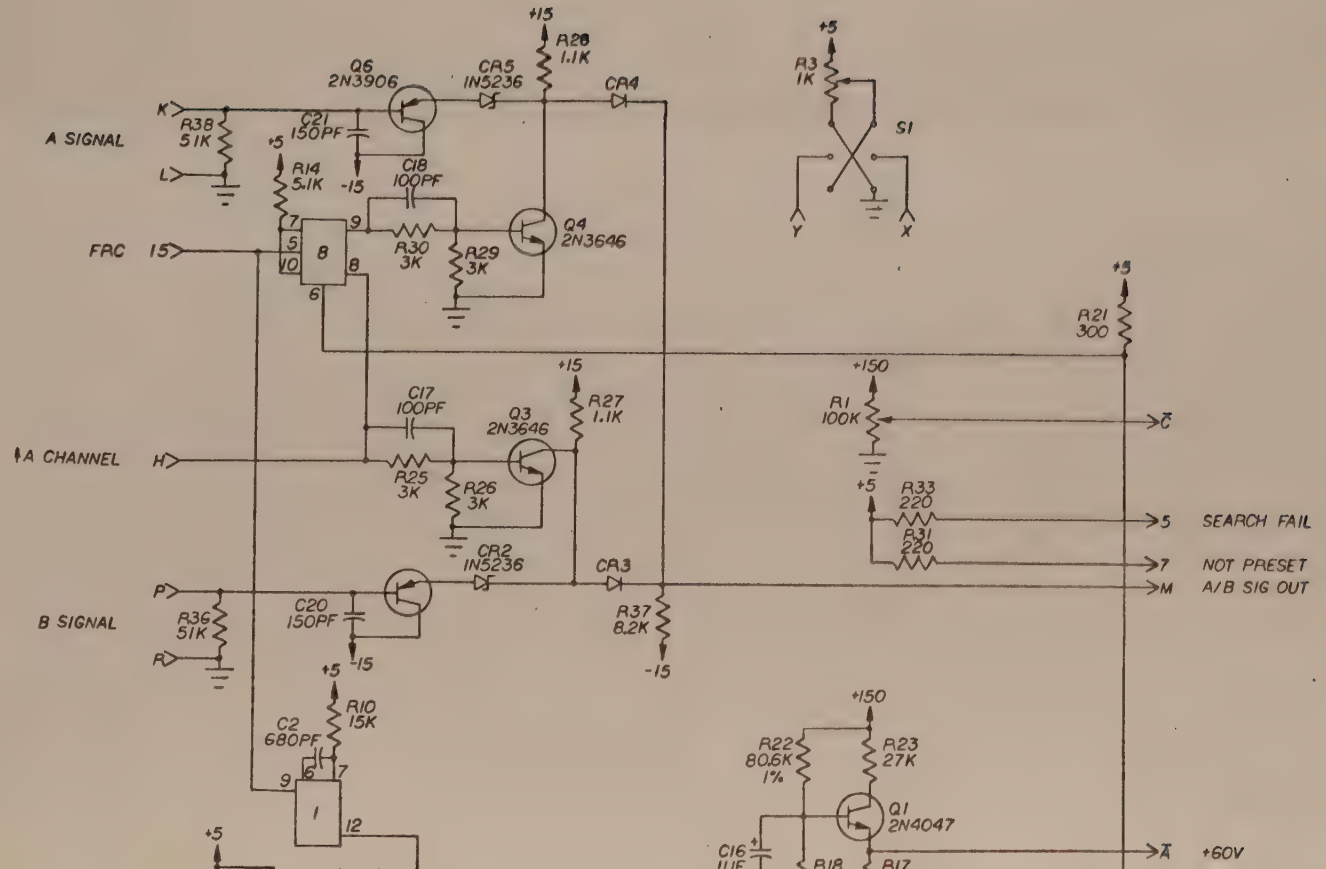
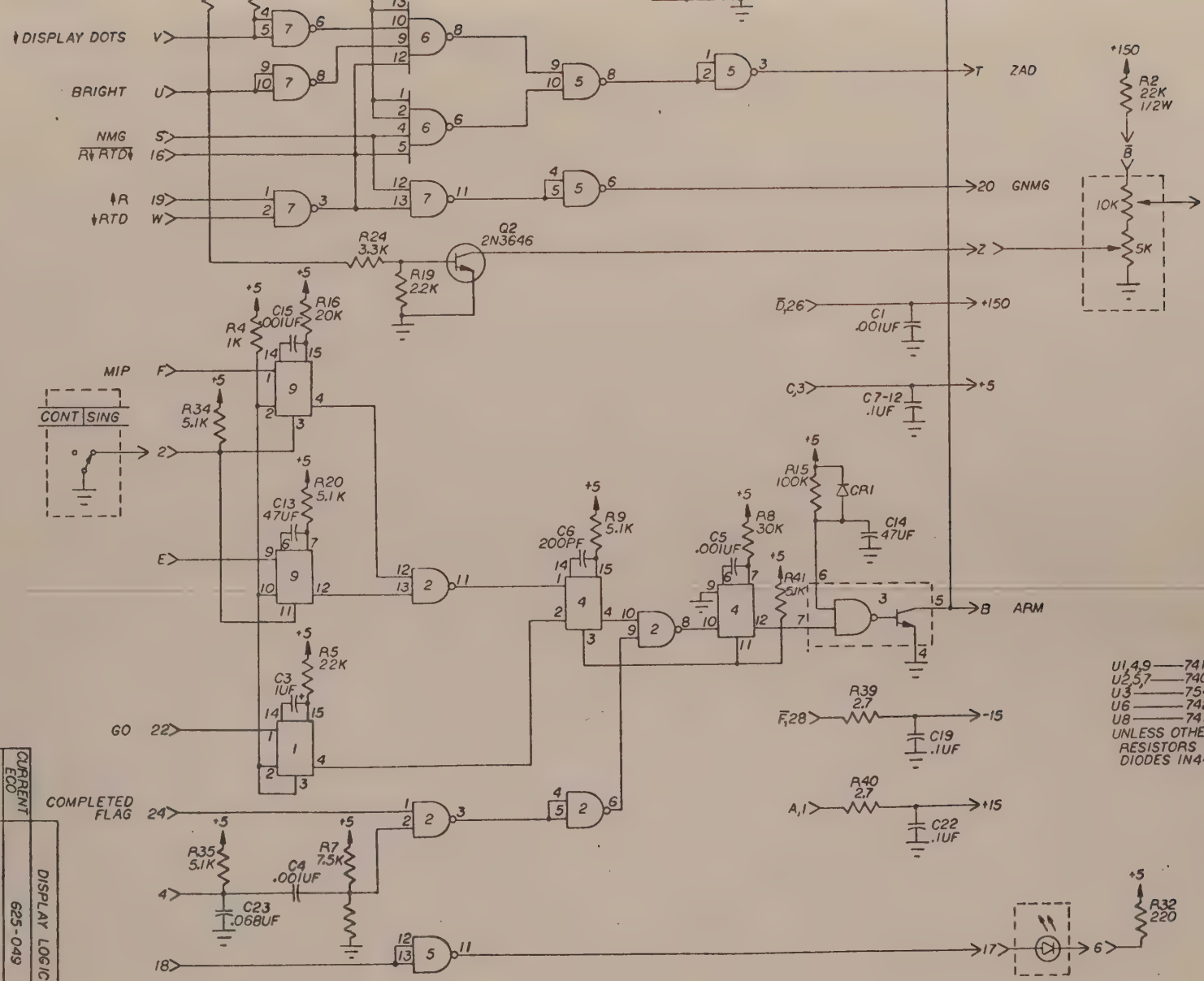
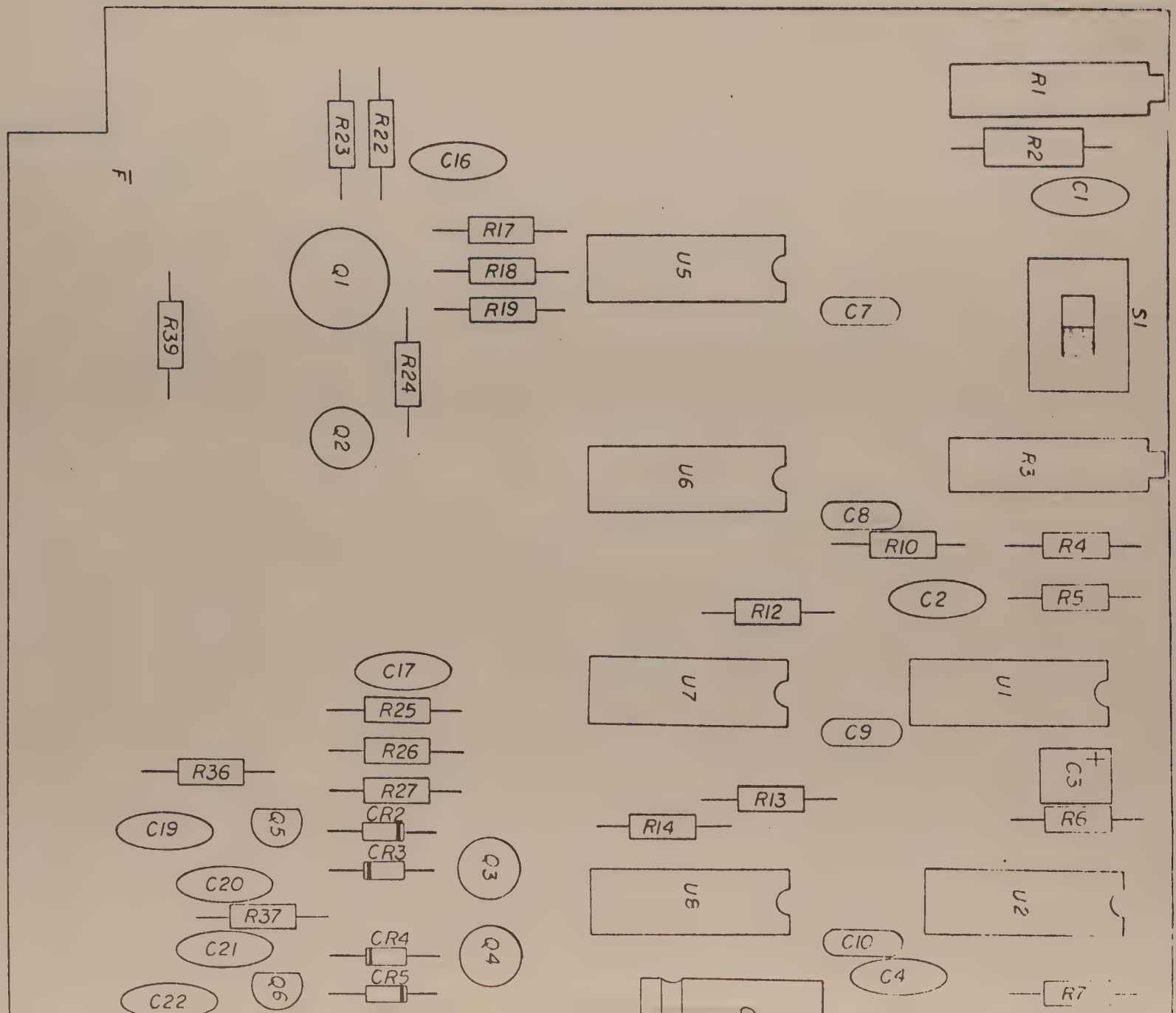


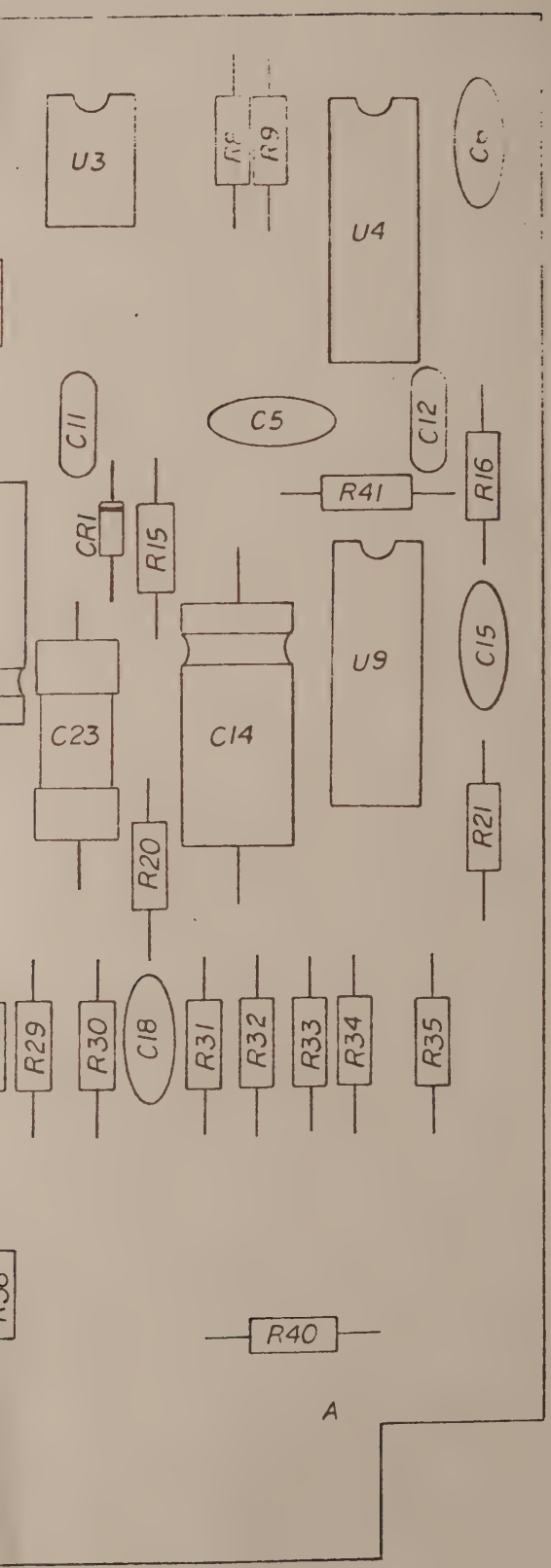
FIGURE 5-4 COAXIAL CABLING DIAGRAM


+15
R28 1.1K
Q6 2N3906
CR5 IN5236
CR4
K
A SIGNAL
R38 51K
L
C21 150PF
+5
-15
R14 5.1K
C18 100PF
FRC
15
Q4 2N3646
R30 3K
R29 3K
+5
R3 1K
S1
Y
X
R21 300
+15
C17 100PF
Q3 2N3646
R27 1.1K
+150
R1 100K
A CHANNEL
H
R25 3K
R26 3K
+5
R33 220
R31 220
5
SEARCH FAIL
7
NOT PRESET
M
A/B SIG OUT
CR2 IN5236
CR3
P
B SIGNAL
R36 51K
R
C20 150PF
-15
R37 8.2K
+5
R10 15K
C2 680PF
+150
R22 80.6K 1%
R23 27K
Q1 2N4047
C16
R18
R17
A
+60V
+5



CURRENT ECO		DISPLAY LOGIC
F	USED: 502	625-049
BD REV		
11-23-77		
AUTEK SYSTEMS CORP	TV	


R1
R2
C1
R23
R22
C16
F
R17
R18
R19
Q1
U5
C7
S1
R39
R24
Q2
U6
R3
C8
R10
R4
C2
R5
R12
C17
U7
U1
R25
C9
R26
R36
C3
R27
R13
C19
Q5
CR2
R14
R6
CR3
Q3
C20
U8
U2
R37
C10
C21
CR4
Q4
C4
R7
CR5
Q6
C22



	DISPLAY LOGIC	
CURRENT ECO	625-049	
C54	USED ON: 502	
BD REV.	6-14-78	JVC
G	AUTEK SYSTEMS CORP.	

PIN	SIGNAL	CONNECTION
A	+15V	A3-1
B	Arm	A5-16,A7-$\overline{B}$,A9-K
C	+5V	Buss
D		A1-23
E	SOR	A7-B,L201
F	MIP	A9-E
H	A DISPLAY	J105-5
J		
K	A Sig	A3-E,A5-24
L	GND	
M	A/B Sig	B1-$\overline{A}$
N	Gnd	
P	B Sig	A4-E,A5-21
R	GND	Buss
S	NMG	A6-U,A9-4
T	ZAD	C3-6
U	Bright↓	J105-30
V	Display Dots↓	J105-43
W	RTD↓	A7-5
X	Trace Rotation	Trace Rotation
Y	Trace Rotation	Coil
Z	Bright↑	R203-2

A1, DISPLAY LOGIC
625-049

PIN	SIGNAL	CONNECTION
$\overline{A}$	+60V	J102-E,J103-E
$\overline{B}$	Intensity	R202-1
$\overline{C}$	Astig	CRT-9
$\overline{D}$	+150V	A3-26
$\overline{E}$		
$\overline{F}$	-15V	A3-28

A1, DISPLAY LOGIC
625-049

PIN	SIGNAL	CONNECTION
1		
2	Sing/Cont.	J105-31
3		
4	Single Meas.	S220-1,J105-32
5	LED P.U.	LED 201A
6	LED P.U.	LED 203A
7	EXT Prog LED	LED 202A
8	Gnd	
9		
10		
11		
12	Gnd	
13	EXT Prog	J106-25,J104-17,S218-C
14		
15	FRC	A5-12,A6-27,A7-$\overline{A}$,A9-V,A10-F
16		
17	E.P. LED	LED 202C
18	Ext Prog	S218-B,B3-F
19	RT↑	A6-25,A7-25,A8-F
20	GNMG	J105-23
21		
22	GO	B2-Z

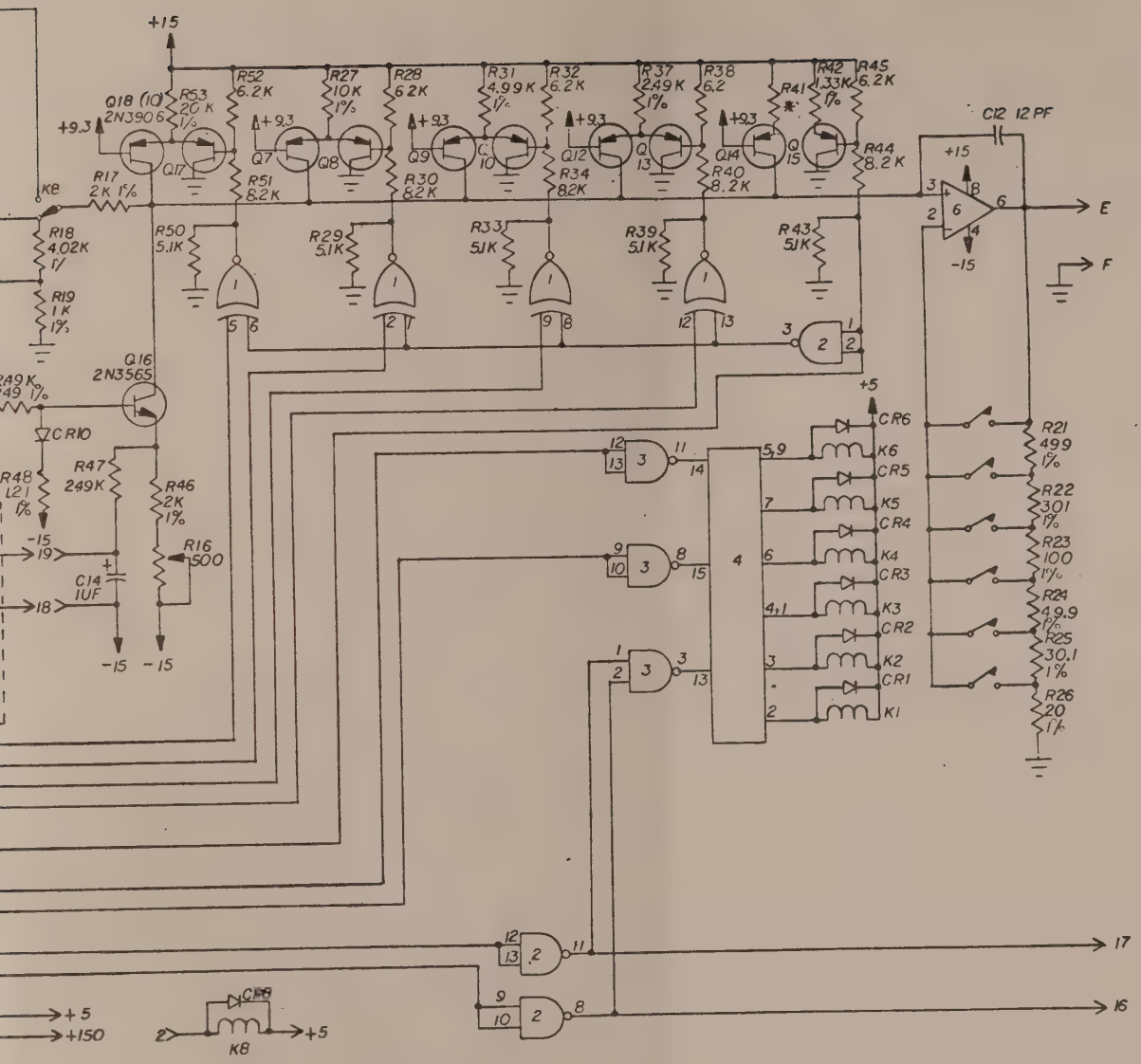
A1, DISPLAY LOGIC
625-049

PIN	SIGNAL	CONNECTION
23		
24	Computer Flag	ASCII J104-12
25		
26		
27	Not Preset	J105-45,R203-3
28		

TITLE	USED ON	B/M		REV.
Display Logic	502	625-049		L
PREP 6-21-77 DATE	CHK DATE	REL DATE	PAGE 1 OF 2	

ITEM	ASSEMBLY OR PART NO.	DESCRIPTION	SCHEM. REF.	QTY ASSY	ISS'D	UNIT COST	UNIT	EXTENSION	SHORT
1	102-2R7	2.7 Ω 1/4 W 5% Res	R39,40	2					
2	102-102	1 k 1/4 W 5% Res	R4	1					
3	102-103	10 k 1/4 W 5% Res	R11 ,10	2					
4	102-104	100 k 1/4 W 5% Res	R15,17	2					
5	102-112	1.1 k 1/4 W 5% Res	R27-30	4					
6	102-203	20 k 1/4 W 5% Res	R16	1					
7	102-221	220 Ω 1/4 W 5% Res	R31-33	3					
8	102-222	2.2 k 1/4 W 5% Res	R19	1					
9	102-223	22 k 1/4 W 5% Res	R5	1					
10	102-273	27 k 1/4 W 5% Res	R23	1					
11	102-301	300 Ω 1/4 W 5% Res	R21	1					
12	102-302	3 k 1/4 W 5% Res	R25,26	2					
13	102-303	30 k 1/4 W 5% Res	R8	1					
14	102-332	3.3 k 1/4 W 5% Res	R24	1					
15	102-512	5.1 k 1/4 W 5% Res	R6,9,12-14, 20,34,35,41	9					
16	102-513	51 k 1/4 W 5% Res	R36,38	2					
17	102-752	7.5 k 1/4 W 5% Res	R7	1					
18	102-822	8.2 k 1/4 W 5% Res	R37	1					
19	103-223	22 k 1/2 W 5% Res	R2	1					
20	107-472	54.9 k 1% RN55D Res	R18	1					
21	107-488	80.6 k 1% RN55D Res	R22	1					
22	125-013	1 k Pot	R3	1					
23	125-015	100 k Pot	R1	1					
24	131-101	100 pF Cap	C17,18	2					
25	131-151	150 pF Cap	C20,21	2					
26	131-201	200 pF Cap	C6	1					

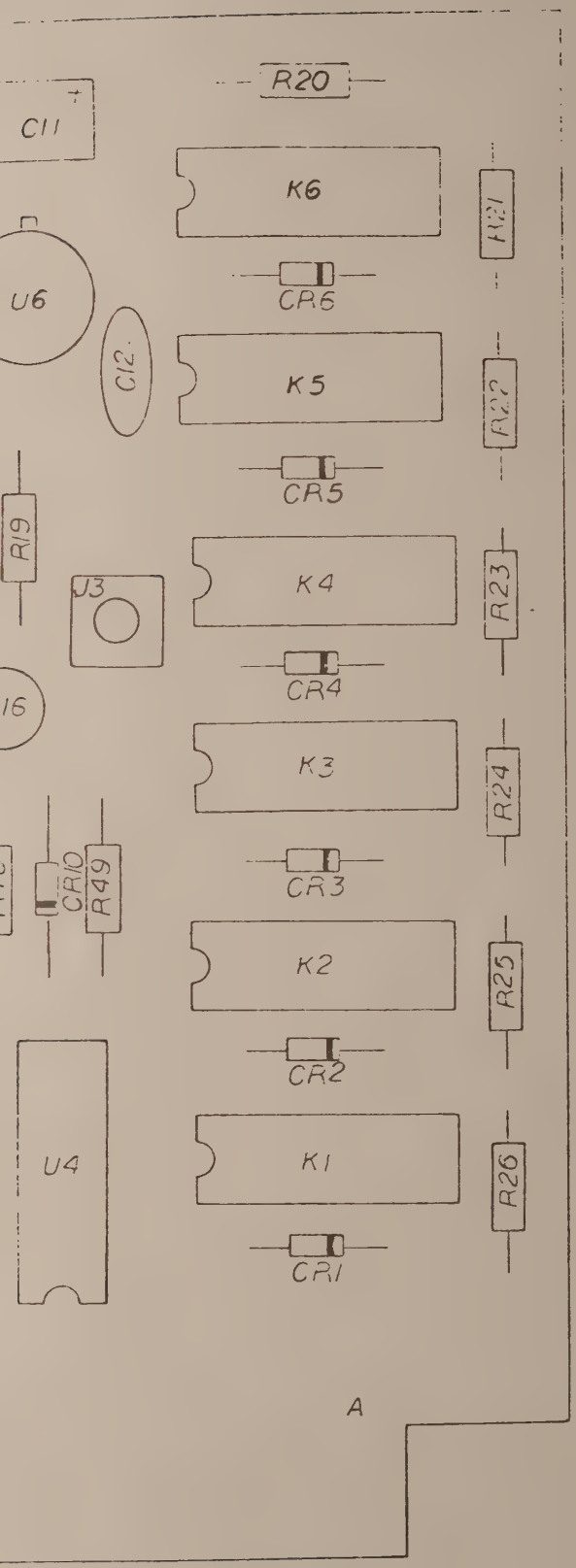
B/M



U1——8242
U23—7400
U4——74145
U5——74123
U6——1456G
UNLESS OTHERWISE SPECIFIED:
RESISTORS 1/4W 5%
DIODE IN4448
*FACTORY SELECT

	PRE-AMP	
CURRENT E.C.O	625-201	
171	USED ON: 502	
BD. REV.	8-22-78	JA
C	AUTEK SYSTEMS CORP.	

J1
C1
R1
R2
C2
Q1
Q2
Q3
C3
R8
Q4
C4
C5
Q5
C7
Q6
P16
R3
C8
R4
R5
C9
R6
R7
R9
R10
CR9
R11
R12
R13
C10
R14
R15
K8
CR8
R17
R18
Q7
Q8
Q9
Q10
Q11
Q12
Q13
Q14
Q15
U2
C14
C15
R27
R28
R29
R30
R31
R32
R33
R34
R35
R36
R37
R38
R39
R40
R41
R42
R43
R44
R45
R46
R47
R50
R51
R52
R53
R54
R55
R56
Q17
Q18
Q19
U5
R57
R58
C13
U1
U2
U3
F



	PRE-AMP, T.I.	
CURRENT ECO	625-201	
066	USED ON: 502	
BD REV	7-15-78	DL
C	AUTEK SYSTEMS CORP	

A3, A PRE-AMPLIFIER
625-201

PIN	SIGNAL	CONNECTION
A	+15V	Buss
B		
C	+5V	Buss
D		
E	A Output	A1-K,A5-24
F	GND	
H		
J		
K		
L		
M		
N		
P	GND	Buss
R	GND	Buss
S	GND	Buss
T		
U		
V		
W		
X		
Y		
Z		

A3, A PRE-AMPLIFIER
625-201

PIN	SIGNAL	CONNECTION
$\overline{A}$		
$\overline{B}$		
$\overline{C}$		
$\overline{D}$	+150V	Buss
$\overline{E}$		
$\overline{F}$	-15V	Buss

A3, A PRE-AMPLIFIER
625-201

PIN	SIGNAL	CONNECTION
1	+15V	Buss
2	182 Mux	A4-2,J106-27
3	+5V	Buss
4		
5		
6		
7		
8	V Mult 2	B3-$\overline{F}$,S201-1,J105-15
9	V Mult 4	B3-28,S201-2,J105-16
10	V Range 1	B3-25,S202-1,J105-13
11	V Range 2	B3-$\overline{D}$,S202-2,J105-14
12	GND	
13	GND	Buss
14	GND	Buss
15	GND	Buss
16	V Range "2"	J106-2,J102-H
17	V Range "1"	J106-1,J102-F
18	A Vert. Pos.	R204
19	A Vert. Pos.	R204
20	Offset Pol +	B3-24,S203-1
21	Offset "4"	B3-8,S204-4
22	Offset "8"	B3-H,S204-8

A3, A PRE-AMPLIFIER
625-201

PIN	SIGNAL	CONNECTION
23	Offset "1"	B3-7,S204-1
24	Offset "2"	B3-J,S204-2
25	STR Gate FRC	A4-25
26		
27		
28		

A4, B PRE-AMPLIFIER
625-201

PIN	SIGNAL	CONNECTION
A	+15V	Buss
B		
C	+5V	Buss
D		
E	"B" Output	A1-P,A5-21
F	GND	
H		
J		
K		
L		
M		
N		
P	GND	Buss
R	GND	Buss
S	GND	Buss
T		
U		
V		
W		
X		
Y		
Z		

A4, B PRE-AMPLIFIER
625-201

PIN	SIGNAL	CONNECTION
$\overline{A}$		
$\overline{B}$		
$\overline{C}$		
$\overline{D}$	+150V	Buss
$\overline{E}$		
$\overline{F}$	-15V	Buss

A4, 8 PRE-AMPLIFIER
625-201

PIN	SIGNAL	CONNECTION
1	+15V	Buss
2	182 Mux	A3-2,J106-27
3	+5V	Buss
4		
5		
6		
7		
8	V Mult. 2	B4-$\overline{F}$,S207-1,J105-19
9	V Mult. 4	B4-28,S207-2,J105-20
10	V Range 1	B4-25,S208-1,J105-17
11	V Range 2	B4-$\overline{D}$,S208-2,J105-18
12	GND	
13	GND	Buss
14	GND	Buss
15	GND	Buss
16	V Range "2"	J106-10,J103-H
17	V Range "1"	J106-9,J103-F
18	"B" Vert Pos.	R205
19	"B" Vert Pos.	R205
20	Offset Pol +	B4-24,S209-1
21	Offset "4"	B4-8,S210-4
22	Offset "8"	B4-H,S210-8

A4, B PRE-AMPLIFIER
625-201

PIN	SIGNAL	CONNECTION
23	Offset "1"	B4-7,S210-1
24	Offset "2"	B4-J,S210-2
25	STR Gate FRC	A10-2
26	+150V	Buss
27		
28	-15V	Buss

TITLE										
PRE AMP, T.I.-1			502				625-201			J
BY	DATE	CHK	BY	DATE			PAGE 1 OF 3			
TV 10/5/77										

ITEM	ASSEMBLY OR PART NO.	DESCRIPTION			SCHEM. REF.	QTY		UNIT COST		
1	102-100	10	1/4W	5% RES	R3, R5	2				
2	102-101	100	1/4W	5% RES	R12	1				
3	102-122	1.2K	1/4W	5% RES	R9	1				
4	102-183	18K	1/4W	5% RES	R13	1				
5	102-242	2.4	1/4W	5% RES	R56	1				
6	102-302	3K	1/4W	5% RES	R4	1				
7	102-304	300K	1/4W	5% RES	R14	1				
8	102-361	360	1/4W	5% RES	R1	1				
					R10,59	1				
10	102-512	5.1K	1/4W	5% RES	R29,R33,R39, R43,R50,R58	8				
11	102-622	6.2K	1/4W	5% RES	R2,R28,R32, R38,R45,R52	6				
12	102-681	680	1/4W	5% RES	R8, R11	2				
13	102-751	750	1/4W	5% RES	R35, R36	2				
14	102-822	8.2K	1/4W	5% RES	R30, R34, R40,R44,R51	5				
15	103-222	2.2K	1/2W	5% RES	R 15	1				
16	103-623	62K	1/2W	5% RES	R6	1				
17	103-182	1.8K	1/2W	5% RES	R7	1				
18	107-130	20	1/8W	1% RES	R26	1				
19	107-147	30.1	1/8W	1% RES	R25	1				
20	107-168	49.9	1/8W	1% RES	R24	1				
21	107-201	100	1/8W	1% RES	R23	1				
22	107-247	301	1/8W	1% RES	R22	1				
23	107-268	499	1/8W	1% RES	R21	1				
24	107-301	1K	1/8W	1% RES	R19	1				
25	107-309	1.21K	1/8W	1% RES	, R48	1				
26	107-313	1.33K	1/8W	1% RES	R42	1				

REVISIONS

TITLE		USED ON	B/M	
PRE AMP, T.I.-1		502, T.I.-1	625-201	J
PREP DATE	CHK DATE	REL DATE	PAGE 2 OF 3	
TV 10/5/77				

ITEM	ASSEMBLY OR PART NO	DESCRIPTION	SCHEM. REF.	QTY	DISC	UNIT COST	LINE	EXTENSION	SHORT
27	107-330	2K 1/8W 1% RES	R17,46	2					
28	107-339	2.49K 1/8W 1% RES	R37,R47,R49	3					
29	107-359	4.02K 1/8W 1% RES	R18	1					
30	107-368	4.99K 1/8W 1% RES	R31, R54	2					
31	107-401	10K 1/8W 1% RES	R27, R55	2					
32	107-418	15K 1/8W 1% RES	R57	1					
33	107-430	20K 1/8W 1% RES	R53	1					
34		*FACTORY SELECT	R41	1					
35	125-052	500 89PR POT RES	R16	1					
36	131-100	10PF DIP MICA CAP	C3, C7	2					
37									
38	131-180	18PF DIP MICA CAP	C2	1					
39	131-620	62PF DIP MICA	C13	1					
40	135-103	.01uF Plastic Film CAP	C6	1					
41	135-152	.0015UF 200V CAP	C1, C5,	2					
42	137-105	1UF 50V CAP	C8,C9,C10, C11,C14,C15	6					
43	150-356	2N3565 TRANSISTOR	Q1,Q2,Q16, Q19	4					
44	150-390	2N3904 TRANSISTOR	Q11	1					
45	151-390	2N3906 TRANSISTOR	Q3,Q6,Q7-10, Q12-15,Q17,Q18	12					
46	153-395	U233/2N3958 TRANSISTOR	Q5	1					
47	153-511	2N5115 TRANSISTOR	Q4	1					
48	160-444	1N4448 DIODE	CR1-10	10					
49	171-123	74123 ONE SHOT I.C.	U5	1					
50	171-700	7400 QUAD 2 in NAND I.C.	U2,U3	2					
51	171-746	74145 1/10 DECODER/DRIVER I.C.	U4	1					
52	171-842	8242 I.C.	U1	1					

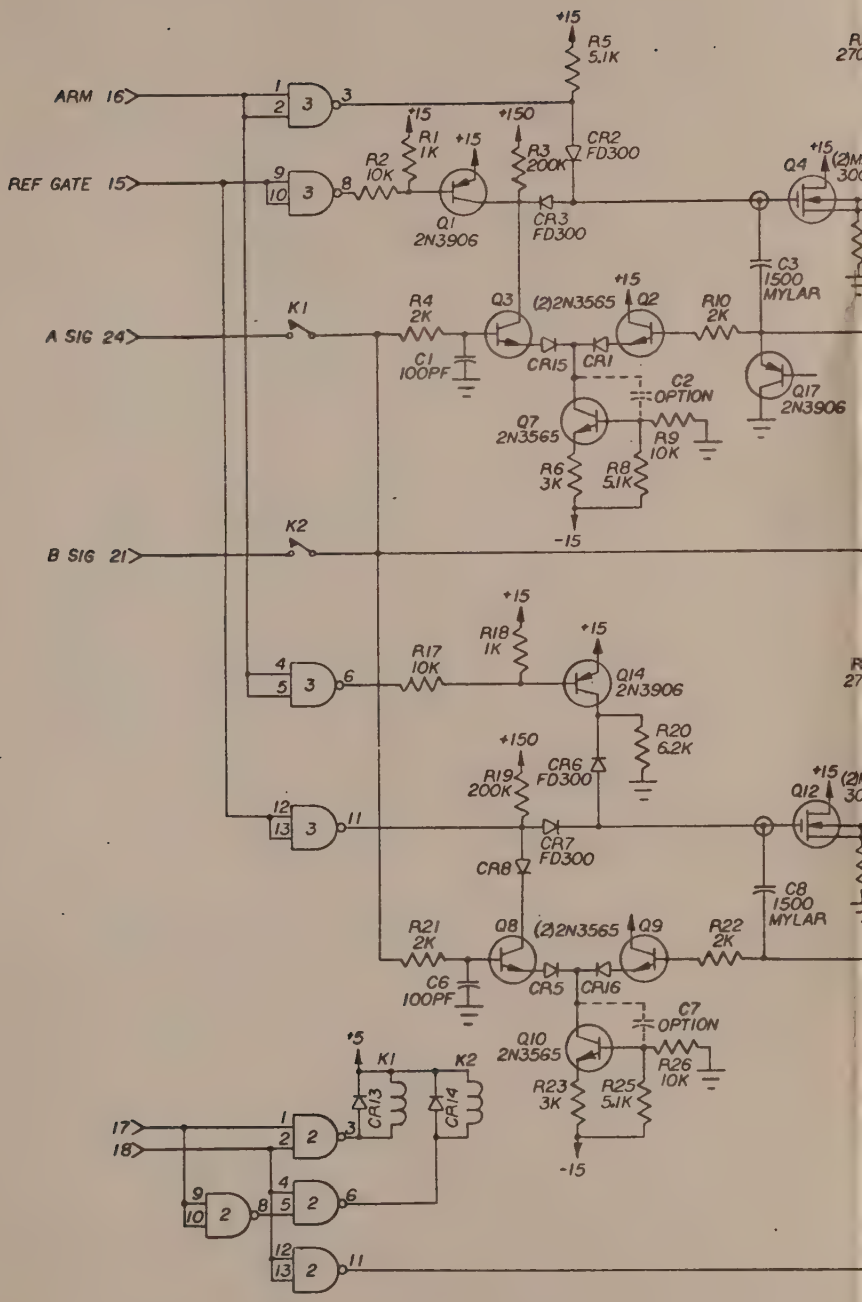
B/M

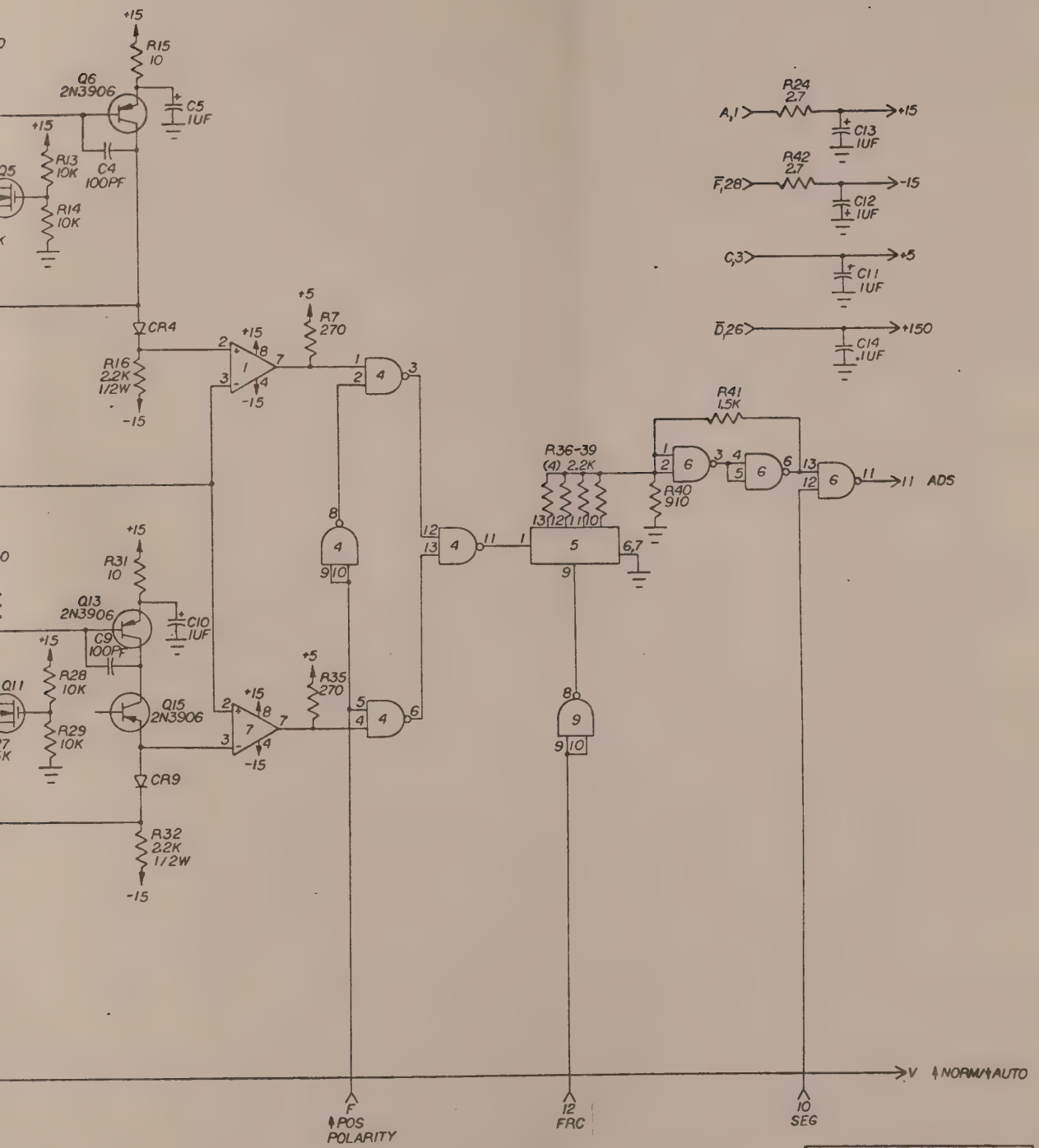
REVISIONS: * INSTALLED BY TEST

TITLE	USED ON	E/L 625-201	
PRE AMP, T.I.-1	502,T.I.-1		
ENGR DATE: TV 10/5/77	CHK DATE	REL DATE	PAGE 3 OF 3

ITEM	ASSEMBLY OR PART NO.	DESCRIPTION	SCHEM. REF.	QTY REQ	QTY USED	UNIT COST	EXT. COST	EXTENSION CHECK
53	178-456	1456 OP-AMP I.C.	U6	1				
54	184-011	DIP RELAY DL1A05	K1-K7	7				
55	184-012	DL1C05 RELAY	K8	1				
56	200-209	209 AEP CONNECTOR	J1,J2,J3	3				
57	525-201	P.C. BOARD	- - - - - - -	1				
58	131-120	12PF DIP MICA CAP	C12	1				

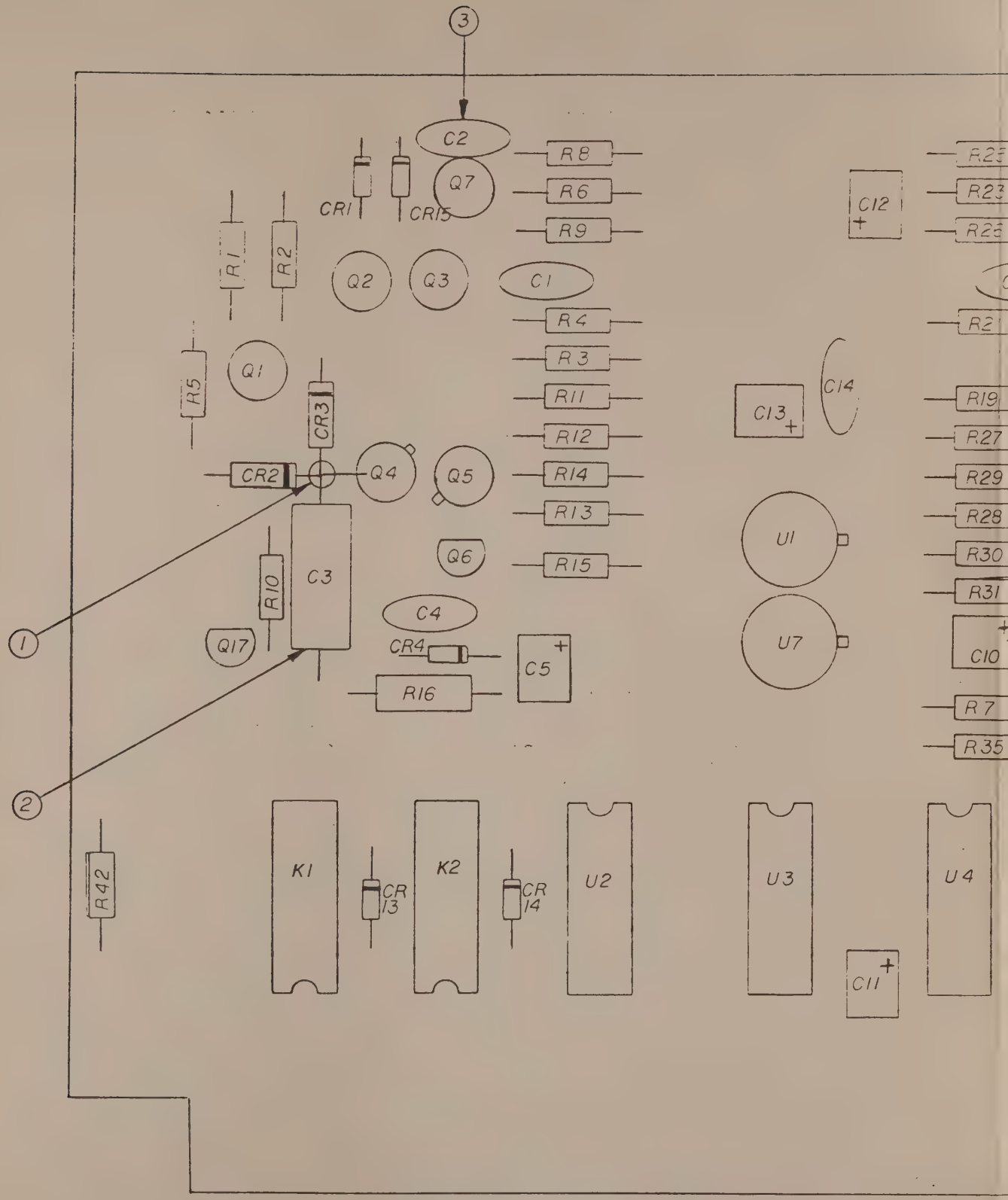
REVISION:

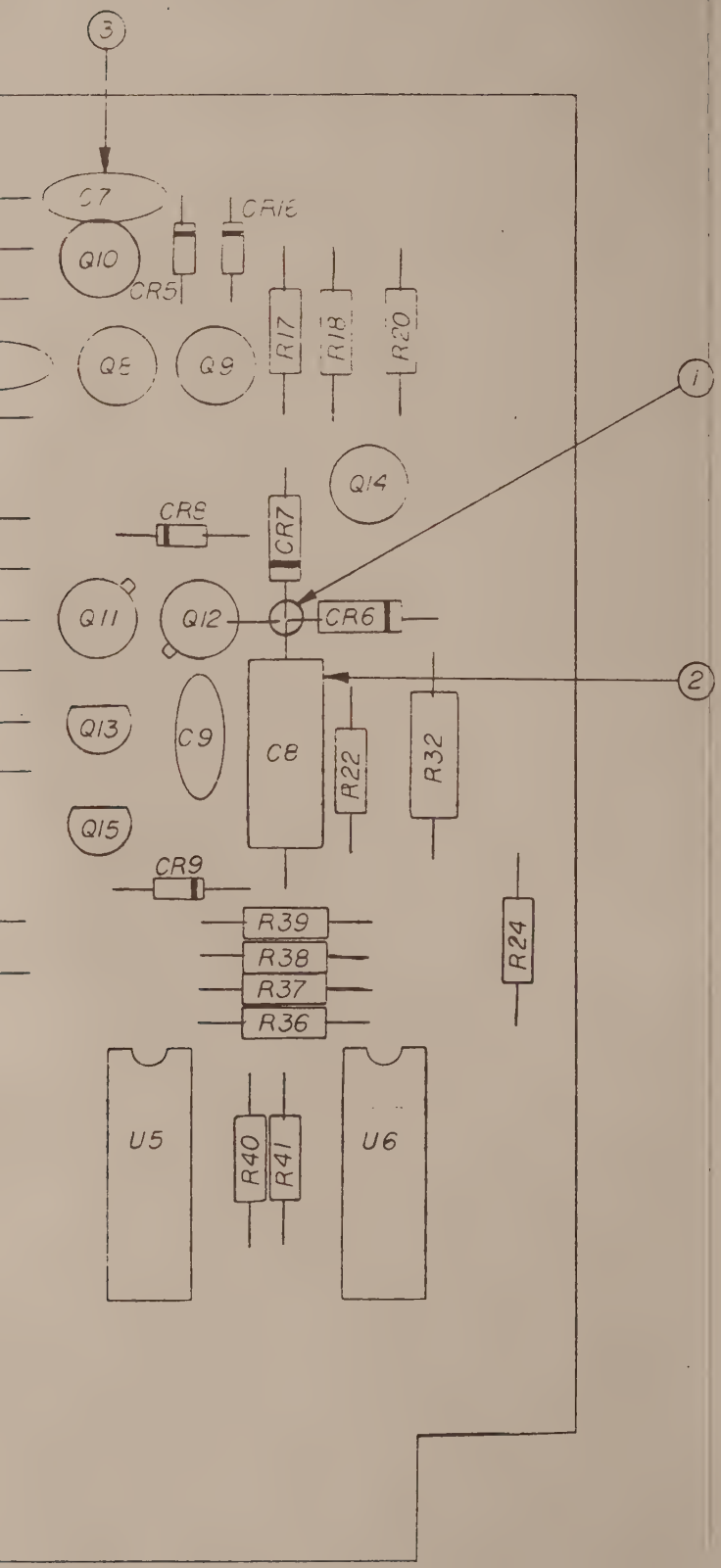

+15
R5
5.1K
ARM 16
REF GATE 15
R1
1K
R2
10K
R3
200K
+150
CR2
FD300
CR3
FD300
Q1
2N3906
Q4
C3
1500
MYLAR
A SIG 24
K1
R4
2K
Q3
(2)2N3565
Q2
R10
2K
C1
100PF
CR15
CR1
C2
OPTION
Q17
2N3906
Q7
2N3565
R9
10K
R6
3K
R8
5.1K
-15
B SIG 21
K2
R18
1K
R17
10K
Q14
2N3906
R20
6.2K
R19
200K
CR6
FD300
Q12
CR7
FD300
CR8
C8
1500
MYLAR
R21
2K
Q8
(2)2N3565
Q9
R22
2K
C6
100PF
CR5
CR16
C7
OPTION
Q10
2N3565
R26
10K
R23
3K
R25
5.1K
-15
+5
CR13
CR14
17
18



U1,7 ——— LM311
U2,4,6 ——— 7400
U3 ——— 7426
U5 ——— 7495
UNLESS OTHERWISE SPECIFIED
RESISTORS 1/4W 5%
DIODES IN4448

	AUTO DELAY	
CURRENT ECO	625-048	
034	USED: 502	
BD REV	11-21-77	TV
C	AUTEK SYSTEMS CORP.	


3
C2
R8
Q7
R6
CR1
CR15
R9
C12
R1
R2
Q2
Q3
C1
R4
R5
Q1
R3
CR3
R11
C13
C14
R12
CR2
Q4
Q5
R14
R13
U1
C3
Q6
R15
R10
C4
1
Q17
CR4
C5
U7
C10
R16
R7
R35
2
R42
K1
CR 13
K2
CR 14
U2
U3
U4
C11



NOTES: (1) INSTALL INSULATED STAND OFF BEFORE INSTALLING COMPONENTS

(2) C3 AND C8 INSTALL AFTER CLEANING BOARD

(3) C2 AND C7 ADD IN TEST AS REQUIRED

	AUTO DELAY	
CURRENT ECO	625-048	
34	USED: M502	
BD REV	6-15-77	TV
C	AUTEK SYSTEMS CORP	

A5, AUTO DELAY
625-048

PIN	SIGNAL	CONNECTION
A	+15V	Buss
B		
C	+5V	Buss
D		
E		
F	Search Gate Pol	B5-4,S217-1
H		
J		
K		
L		
M		
N		
P		
R	GND	Buss
S		
T		
U		
V	↑NORM/↓Auto	A9-T,A7-18
W		
X		
Y		
Z		

PIN	SIGNAL	CONNECTION
$\overline{A}$		
$\overline{B}$		
$\overline{C}$		
$\overline{D}$	+150V	Buss
$\overline{E}$		
$\overline{F}$	-15V	Buss

A5, AUTO DELAY
625-048

PIN	SIGNAL	CONNECTION
1		
2		
3		
4		
5		
6		
7		
8		
9		
10	SEG	A6-T,A7-$\overline{E}$,A8-B,A9-L
11	ADS	A9-U
12	FRC	A1-15,A7-A,A6-27,A9-V,A10-F
13		
14		
15	Ref Gate	A9-J,J105-44
16	Arm	A9-K,A1-B,A7-$\overline{B}$
17	DEL MODE "2"	B5-E,S217-2
18	DEL MODE "4"	B5-5,S217-4
19		
20		
21	"B" Sig	A4-E,A1-P
22		

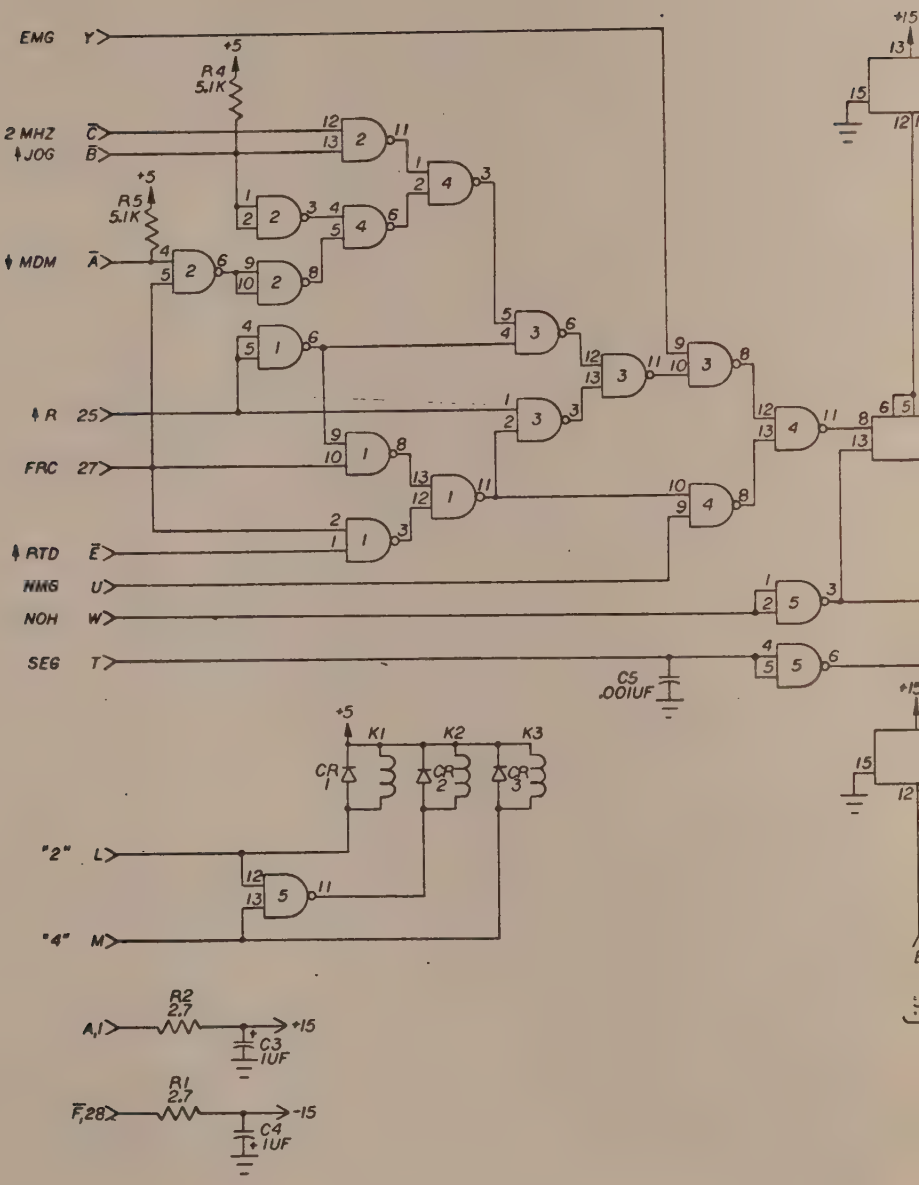
A5, AUTO DELAY
625-048

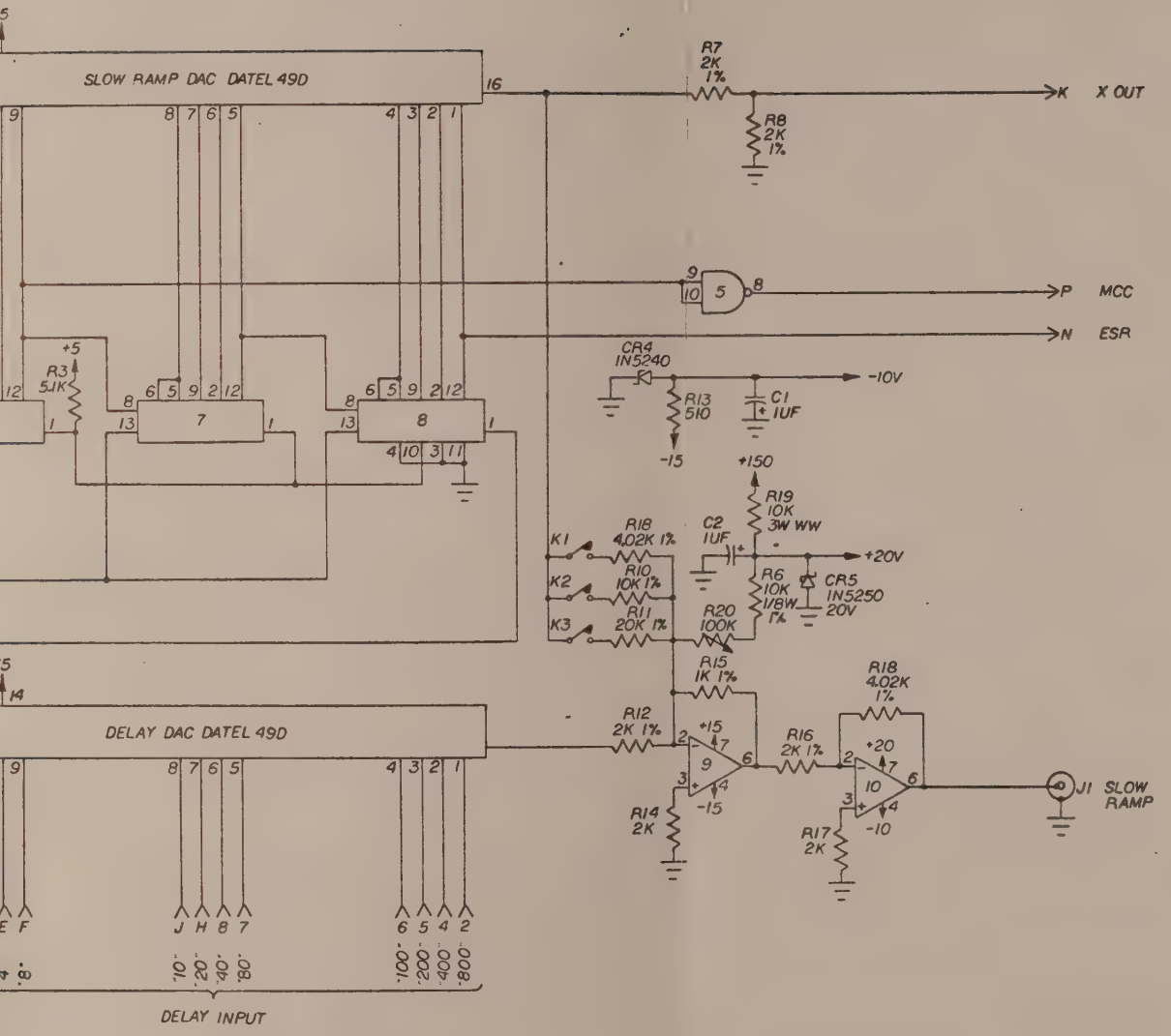
PIN	SIGNAL	CONNECTION
23		
24	"A" Sig	A1-K,A3-E
25		
26		
27		
28		

Auto Delay					502	E/M	625-048	H
	6-30-75	CHK	Oak 6/30/75	DATE		PAGE 1 OF 2		REV

ITEM	ASSEMBLY OR PART NO.	DESCRIPTION			SCHEM. REF.	QTY PER ASSY	UNIT COST	EXTENSION	SPC
1	102-207	2.7 ohm	1/4w 5%	Res	R24,42	2			
2	102-101	100 ohm	1/4w 5%	Res	R15,31	2			
3	102-102	1 k	1/4w 5%	Res	R1 18,	2			
4	102-103	10 k	1/4w 5%	Res	R2,9,13,14, 17,26,28,29	8			
5	102-134	130 k	1/4w 5%	Res	R12,30	2			
6	102-152	1.5 k	1/4w 5%	Res	R5,20,41	3			
7	102-202	2 k	1/4w 5%	Res	R4,10,21,22	4			
8	102-204	200 k	1/4w 5%	Res	R3,19	2			
9	102-222	2.2 k	1/4w 5%	Res	R36-39	4			
10	102-302	3 k	1/4w 5%	Res	R6,23	2			
11	102-362	3.6 k	1/4w 5%	Res	R11,27	2			
12	102-512	5.1 k	1/4w 5%	Res	R8,25	2			
13	102-911	910 ohm	1/4w 5%	Res	R40	1			
14	103-222	2.2 k	1/2w 5%	Res	R16,32	2			
15	131-101	100 pF		Cap	C1,4,6,9	4			
16	133-102	.001 uF	Disc	Cap	C14	1			
17	136-105	.0015 uF	Polystyrene		C3,8	2			
18	137-105	1 uF	50V	Cap	C5,10,11-13	5			
19	150-356	2N3565			Q2,3,7-10	6			
20	151-390	2N3906			Q1,6,13-15, 17	6			
21	153-300	MFE3001			Q4,5,11,12	4			
22	160-030	FD300		Diode	D2,3,6,7	4			
23	160-444	IN4448		Diode	D1,4,5,8,9 13-16	9			
25	178-312	LM311			IC 1,7	2			
26	171-700	7400			IC 2,4,6	3			

TITLE										
Auto Delay 502			B/M 625-048							H
DATE 6-30-75	CHK Acur DATE 6/30/75		PAGE 2 OF 2							REV
ITEM	ASSEMBLY OR PART NO	DESCRIPTION	SCHEM REF	QTY ASSY	ISSUE	UNIT COST	UNIT	EXTENSION	SHOP
27	171-726	7426	IC 3	1					
28	171-795	7495	IC 5	1					
29	184-011	Dip Relay, DLIA05	K1,2	2					
30	255-003	Stand off Insulator	-----	2					
31	525-048	P.C. Board	-----	1					
32	102-271	270Ω 1/4W 5% Resistor	R7,35	2					

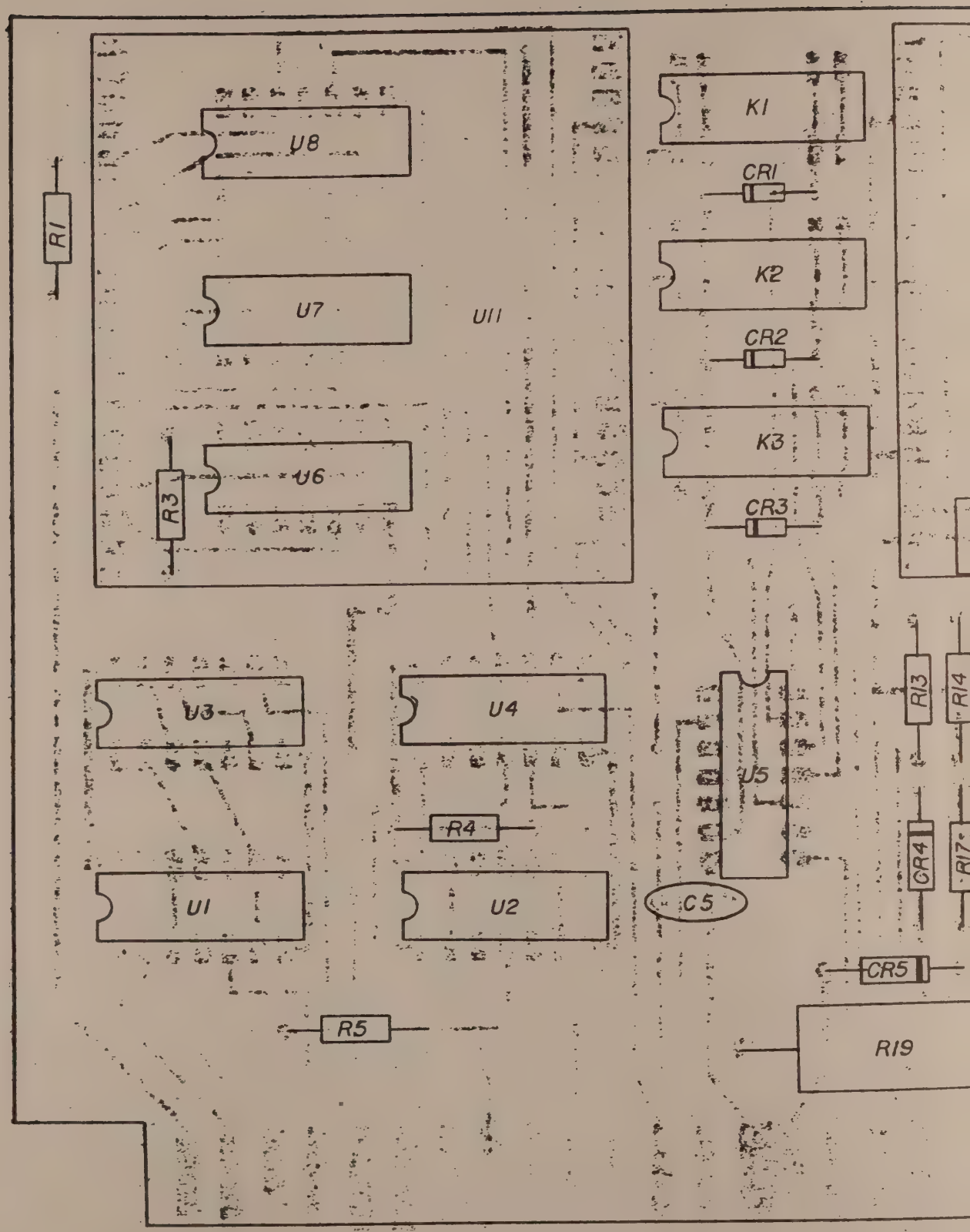

EMG Y
+5
R4 5.1K
2 MHZ C
JOG B
R5 5.1K
MDM A
R 25
FRC 27
RTD E
NMS U
NOH W
SEG T
C5 .001UF
K1
K2
K3
CR 1
CR 2
CR 3
"2" L
"4" M
R2 2.7
A,1
C3 1UF
+15
R1 2.7
F,28
-15
C4 1UF

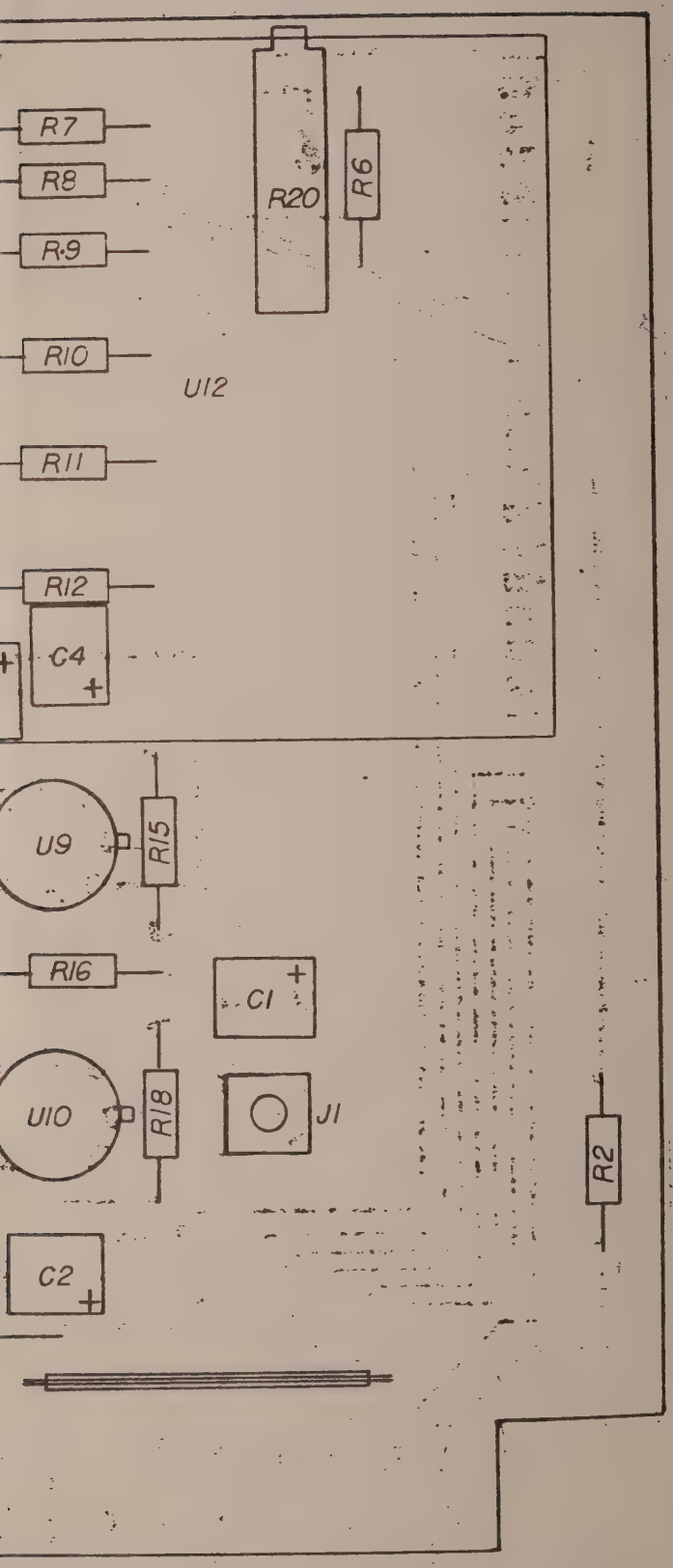


U1-5 — 7400
U6-8 — 8280
U9,10 — 1456G

UNLESS OTHERWISE SPECIFIED:
RESISTORS 1/4W 5%
DIODES IN4448

	SLOW RAMP	
CURRENT ECO	625-045	
026	USED: 502	
BD REV	11-17-77	TV
C	AUTEK SYSTEMS CORP	


U8
K1
CR1
R1
U7
U11
K2
CR2
K3
CR3
U6
R3
U3
U4
R13
R14
U5
R4
CR4
R17
U1
U2
C5
CR5
R5
R19



	SLOW RAMP	
CURRENT ECO	625-045	
26	USED ON: 502	
BD REV	8-18-77	DL
C	AUTEK SYSTEMS CORP	

A6, SLOW RAMP
625-045

PIN	SIGNAL	CONNECTION
A	+15V	Buss
B	Del. Dac 1	A7-Y
C	+5V	Buss
D	Del. Dac 2	A7-X
E	Del. Dac 4	A7-Z
F	Del. Dac 8	A7-W
H	Del. Dac 20	A7-N
J	Del. Dac 10	A7-U
K	X-Out	B1-L
L		A8-$\overline{A}$,B5-$\overline{F}$,S213-1
M		A8-$\overline{B}$,B5-28,S213-2
N	ESR	A9-$\overline{C}$
P	MCC	J105-37
R	GND	Buss
S	GND	
T	SEG	A5-10,A7-$\overline{E}$,A8-B,A9-L
U	NMG	A1-S,A9-4
V		
W	NOH	A7-22,A9-D,A8-27
X		
Y	EMG	A9-H
Z		

A6, SLOW RAMP
625-045

PIN	SIGNAL	CONNECTION
$\overline{A}$	MDM	J105-27
$\overline{B}$	JOG	J105-36
$\overline{C}$	2 MHz	A8-$\overline{C}$,J105-1
$\overline{D}$	+150V	Buss
$\overline{E}$	RTD	A7-2
$\overline{F}$	15V	Buss

A6, SLOW RAMP
625-045

PIN	SIGNAL	CONNECTION
1		
2	Del. Dac 800	A7-E
3		
4	Del. Dac 400	A7-L
5	Del. Dac 200	A7-F
6	Del. Dac 100	A7-K
7	Del. Dac 80	A7-M
8	Del. Dac 40	A7-V
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		

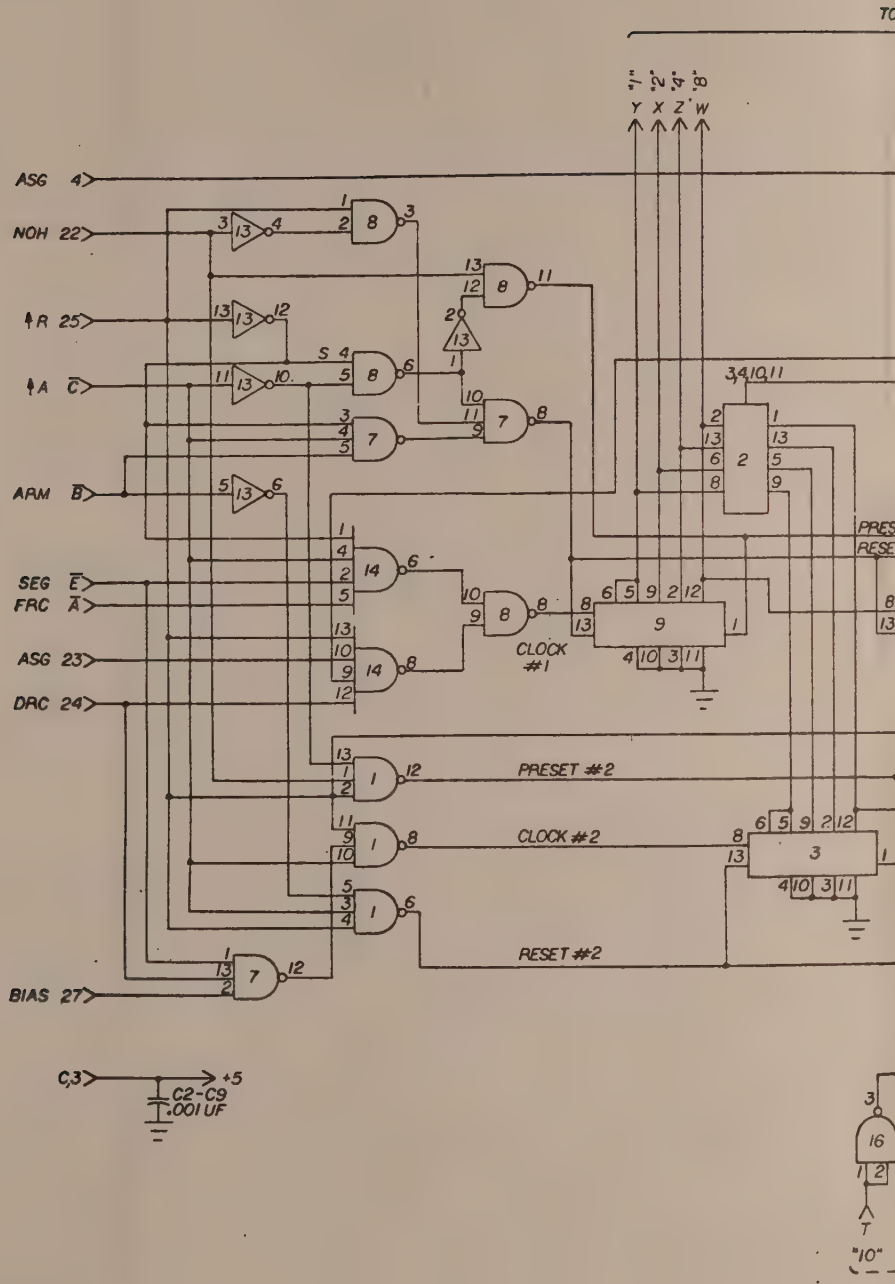
A6, SLOW RAMP
625-045

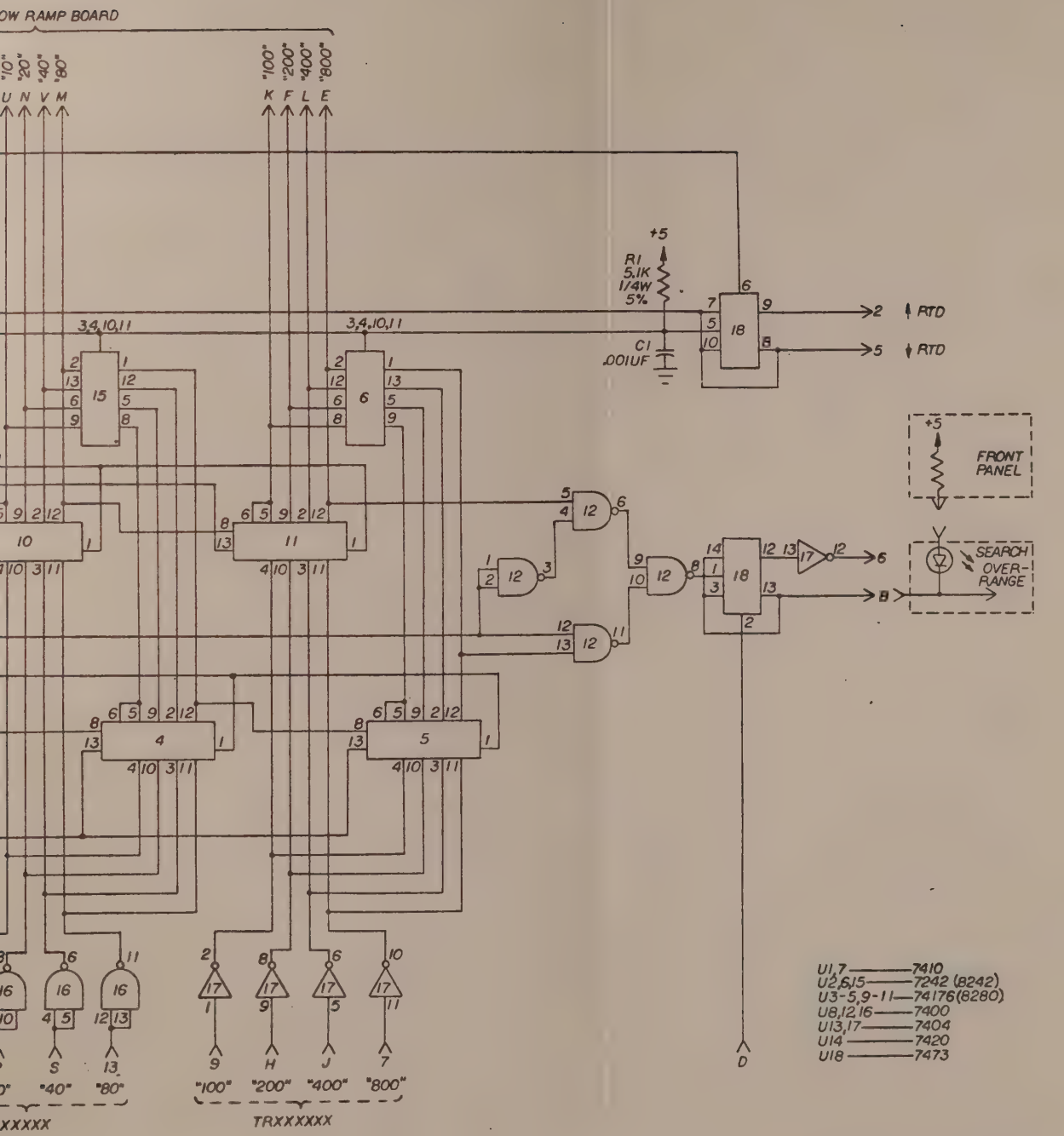
PIN	SIGNAL	CONNECTION
23		
24		
25	↑RT	A7-25,A8-F,A1-19
26		
27	FRC	A1 15,A7-$\overline{A}$,A5-12,A9 V,A10-F
28		

TITLE: Slow Ramp | USED ON: 502 | B/M 625-045 | B

PREP DATE: 6-20-77 | PAGE 1 OF 1

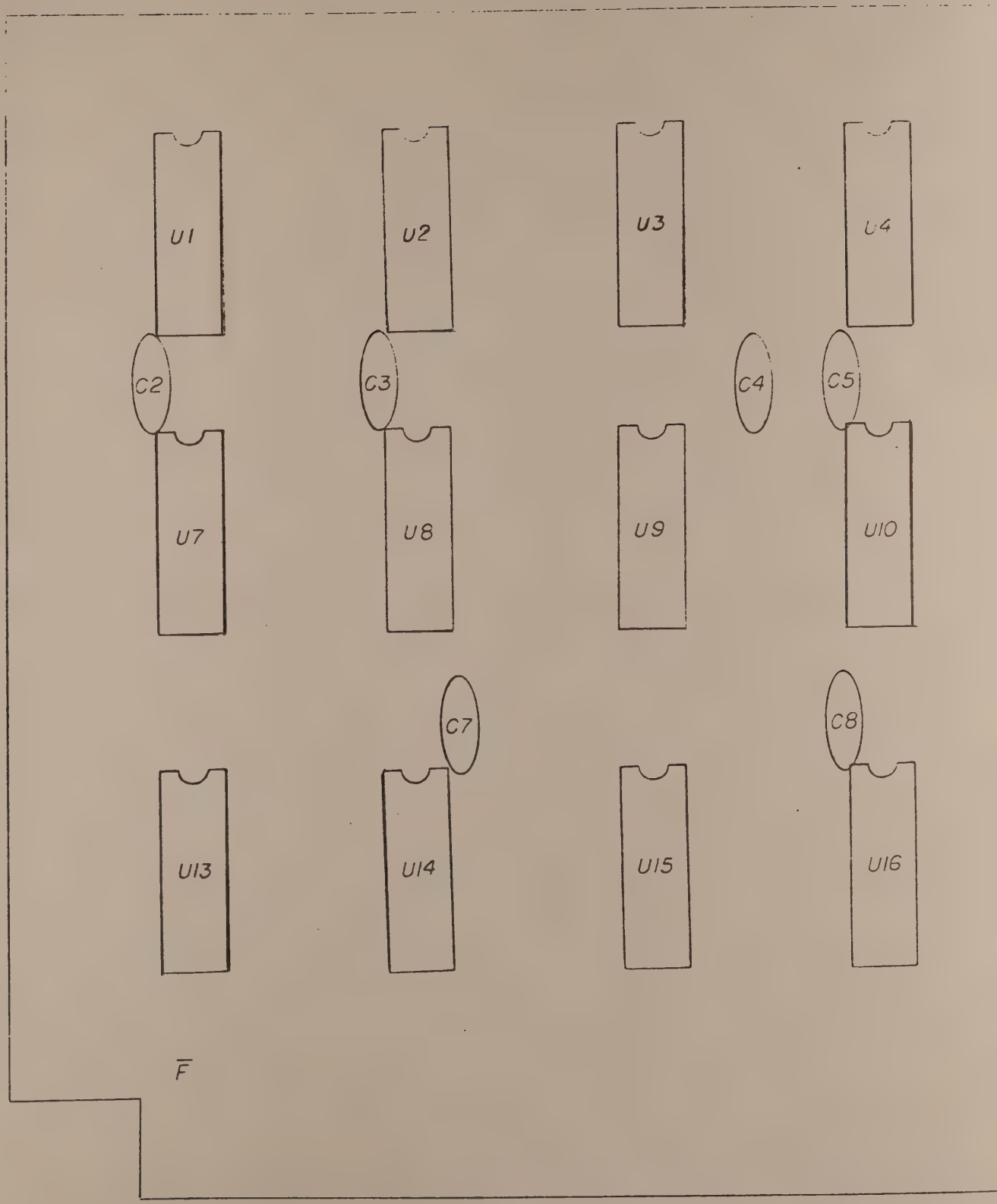
ITEM	ASSEMBLY OR PART NO.	DESCRIPTION	SCHEM REF	QTY
1	102-027	2.7 Ω 1/4 W 5% Res	R1,2	2
2	102-202	2 k 1/4 W 5% Res	R14.17	2
3	102-511	510 Ω 1/4 W 5% Res	R13	1
4	102-512	5.1 k 1/4 W 5% Res	R3,4,5	3
5	107-301	1 k 1% RN55D Res	R15	1
6	107-330	2 k 1% RN55D Res	R7,8,12,16	4
7	107-359	4.02 k 1% RN55D Res	R9,18	2
8	107-401	10 k 1% RN55D Res	R10,16	2
9	107-430	20 k 1% RN55D Res	R11	1
10	114-103	10 k 3W WW Res	R19	1
11	125-015	100 k Pot	R20	1
12	132-102	.001 µF Disc Cap	C5	1
13	137-105	1 µF 50 V Cap	C1-4	4
14	160-444	1N4448 Diode	CR1-3	3
15	164-540	1N5240 Diode	CR4	1
16	164-550	1N5250 20 V Zener Diode	CR 5	1
17	171-700	MC7400 IC	U1-5	5
18	171-880	DM8280A/74176 IC	U6-8	3
19	178-456	1456 IC	U9-10	2
21	184-011	Relay, DL1A05	K1-3	3
22	200-209	Connector	J1	1
23	208-020	Sockets 20 pin in line		4
24	525-045	P. C. Board, Slow Ramp		1

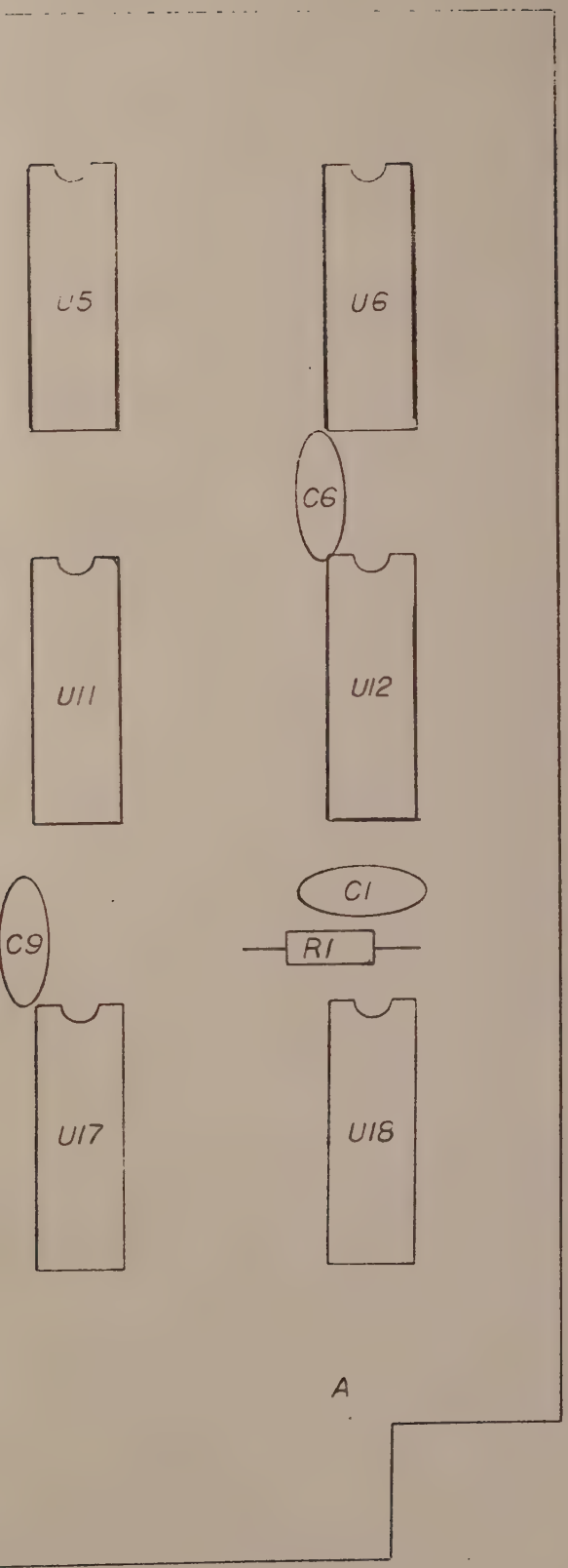

TO
"1" Y
"2" X
"4" Z
"8" W
ASG 4
NOH 22
R 25
A C
ARM B
SEG E
FRC A
ASG 23
DRC 24
BIAS 27
CLOCK #1
PRESET #2
CLOCK #2
RESET #2
C2-C9 .001 UF
C,3
+5
"10"



U1,7 ——— 7410
U2,6,15 ——— 7242 (8242)
U3-5,9-11 ——— 74176 (8280)
U8,12,16 ——— 7400
U13,17 ——— 7404
U14 ——— 7420
U18 ——— 7473

	DELAY LOGIC	
CURRENT ECO	625-046	
040	USED: 502	
BD REV	11-18-77	TV
C	AUTEK SYSTEMS CORP	


U1
U2
U3
U4
C2
C3
C4
C5
U7
U8
U9
U10
C7
C8
U13
U14
U15
U16
F



	DELAY RAMP LOGIC	
CURRENT ECO	625-046	
040	USED ON: 502	
BD REV	12-12-77	V. BORLAUG
D	AUTEK SYSTEMS CORP	

A7, DELAY LOGIC
625-046

PIN	SIGNAL	CONNECTION
A	+15V	Buss
B	↓SOR	A1-E,L201
C	+5V	Buss
D	SOR Reset	A9-B
E	Del Dac 800	A6-2
F	Del Dac 200	A6-5
H		B5-$\overline{B}$,S215-2
J		B5-24,S215-4
K	Del Dac 100	A6-6
L	Del Dac 400	A6-4
M	Del Dac 80	A6-7
N	Del Dac 20	A6-H
P		B5-J,S216-2
R	GND	Buss
S		B5-8,S216-4
T		B5-7,S216-1
U	Del Dac 10	A6-j
V	Del Dac 40	A6-8
W	Del Dac 8	A6-F
X	Del Dac 2	A6-D
Y	Del Dac 1	A6-B
Z	Del Dac 4	A6-E

A7, DELAY LOGIC
625-046

PIN	SIGNAL	CONNECTION
$\overline{A}$	FRC	A1-15,A5-12,A6-27,A9-V
$\overline{B}$	ARM	A5-16,A9-K,A1-B
$\overline{C}$	↑N/A↑	A5-18
$\overline{D}$	+150V	Buss
$\overline{E}$	SEG	A5-10,A9-L,A6-T,A8-B
$\overline{F}$	-15V	Buss

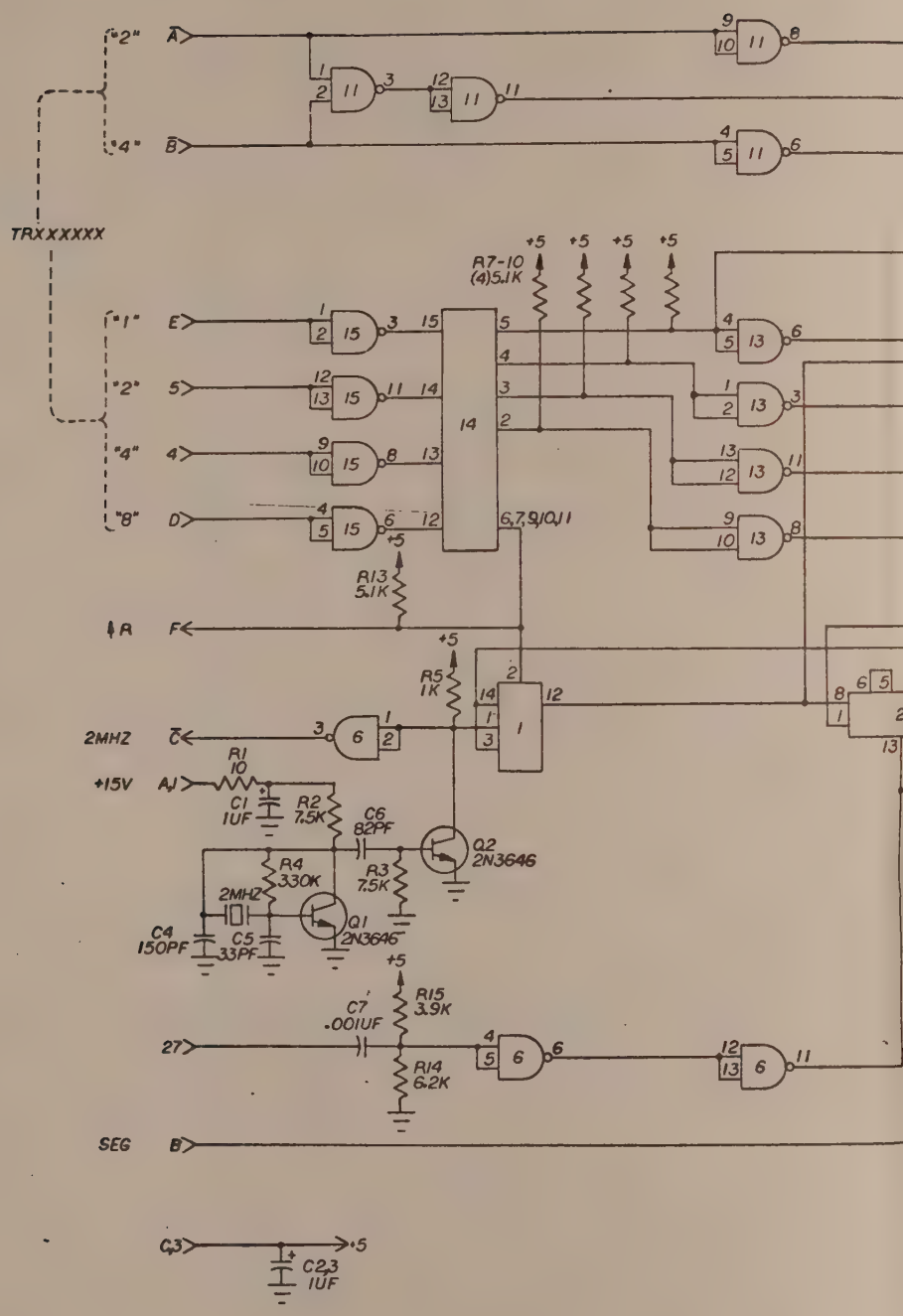
PIN	SIGNAL	CONNECTION
1		
2	RTD	A6-$\overline{E}$
3		
4	ASG	A9-5,A7-23
5	RTD	A1-W
6	SOR	J105-28
7		B5-$\overline{A}$,S215-8
8		
9		
10		
11		
12		
13		B5-H,S216-8
14		
15		
16		
17		
18		
19		
20		
21		
22	NOH	A9-D,A6-W,A8-27

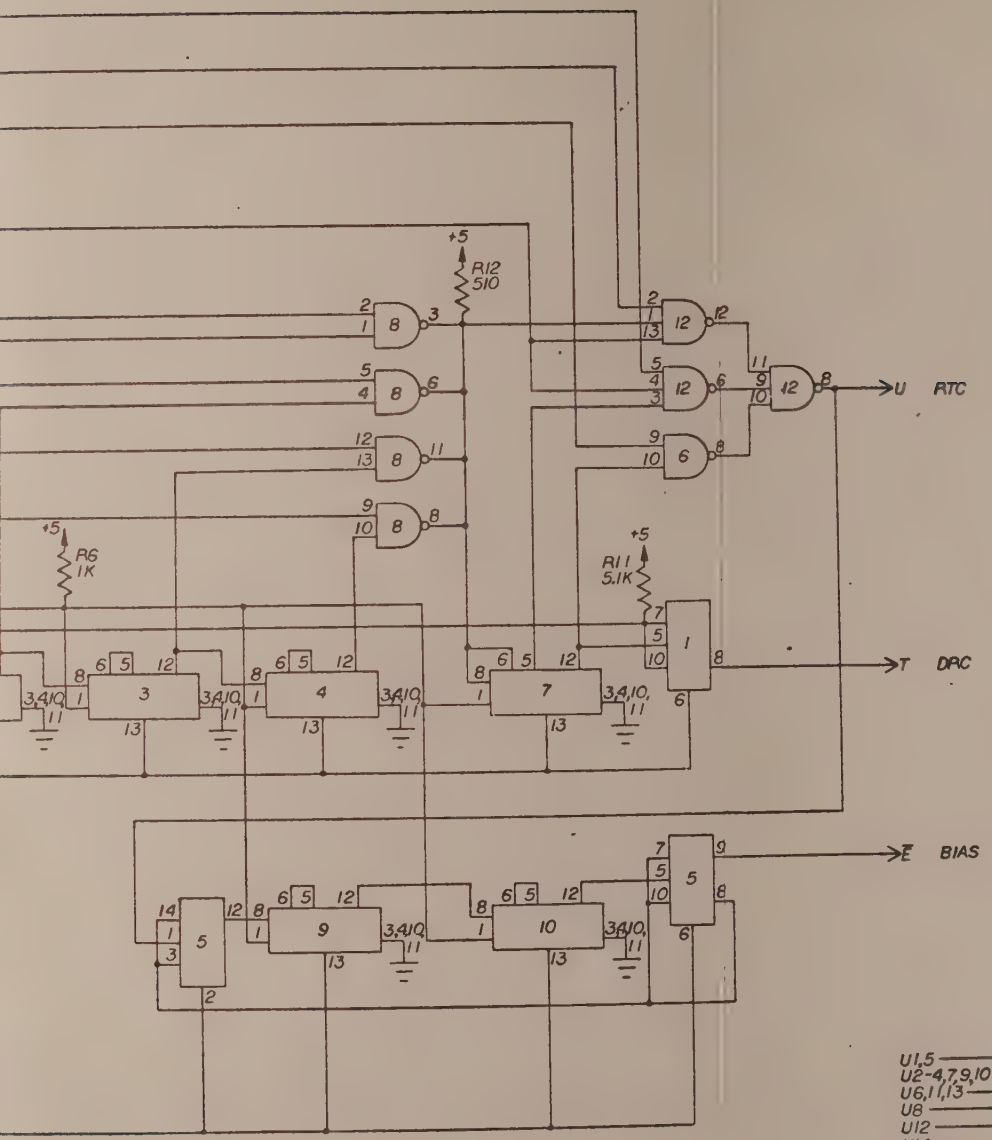
A7, DELAY LOGIC
625-046

PIN	SIGNAL	CONNECTION
23	ASG	A7-4,A9-5
24	DRC	A8-T
25	RT↑	A6-26,A8-F,A1-19
26		
27	200 Bias	A8-$\overline{E}$
28		

TITLE		USED ON	B/M		REV
Delay Logic		502	625-046		G
REB 6-20-75	DATE	DATE	PAGE 1 OF 1		

ITEM	MODEL OR PART NO.	DESCRIPTION	SCH. REF.	QTY.		UNIT COST		EXTENSION	UNIT
1	102-512	5.1 k 1/4w 5% Res	R1	1					
2	133-102	.001 uF Disc Cap	C1	1					
3	171-700	MC7400	IC 8.12, 16	3					
4	171-704	MC7404	IC 13, 17	2					
5	171-710	MC7410	IC 1,7	2					
6	171-720	MC7420	IC 14	1					
7	171-773	MC7473	IC 18	1					
8	171-842	8242	IC2,6,15	3					
9	171-880	8280/74176	IC3-5,9-11	6					
10	525-046	P.C. Board	-----	1					
11	133-104	.1 uF 50V 80% Cap	C2-C6	8					

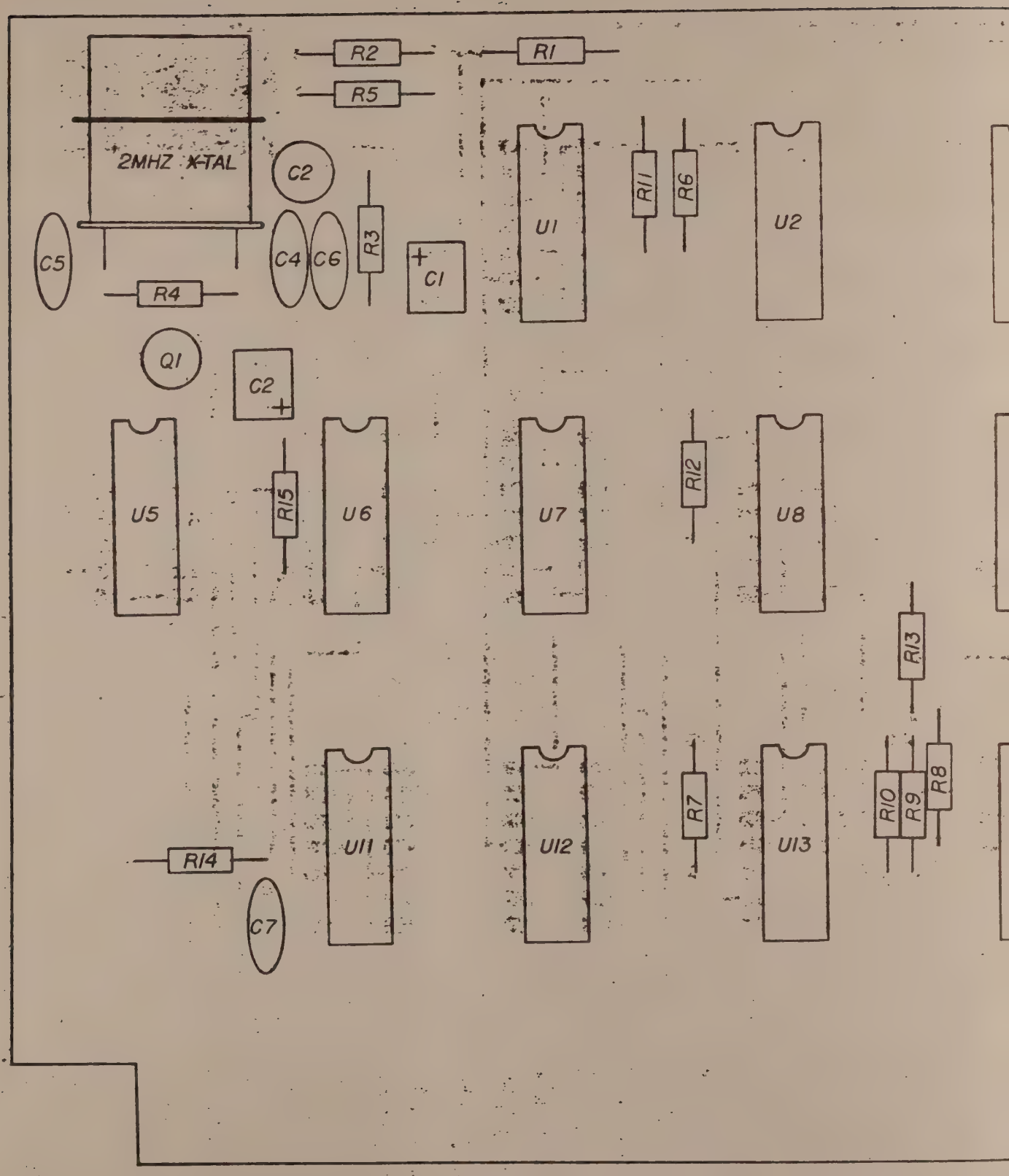

TRXXXXXX
"2"
"4"
"1"
"2"
"4"
"8"
A
B
E
5
4
D
R7-10
(4)5.1K
+5
R13
5.1K
R
F
R5
1K
2MHZ
C
+15V
ADJ
R1
10
C1
1UF
R2
7.5K
C6
82PF
Q2
2N3646
R4
330K
R3
7.5K
2MHZ
Q1
2N3646
C4
150PF
C5
33PF
R15
3.9K
C7
.001UF
27
R14
6.2K
SEG
B
C3
+5
C2,3
1UF

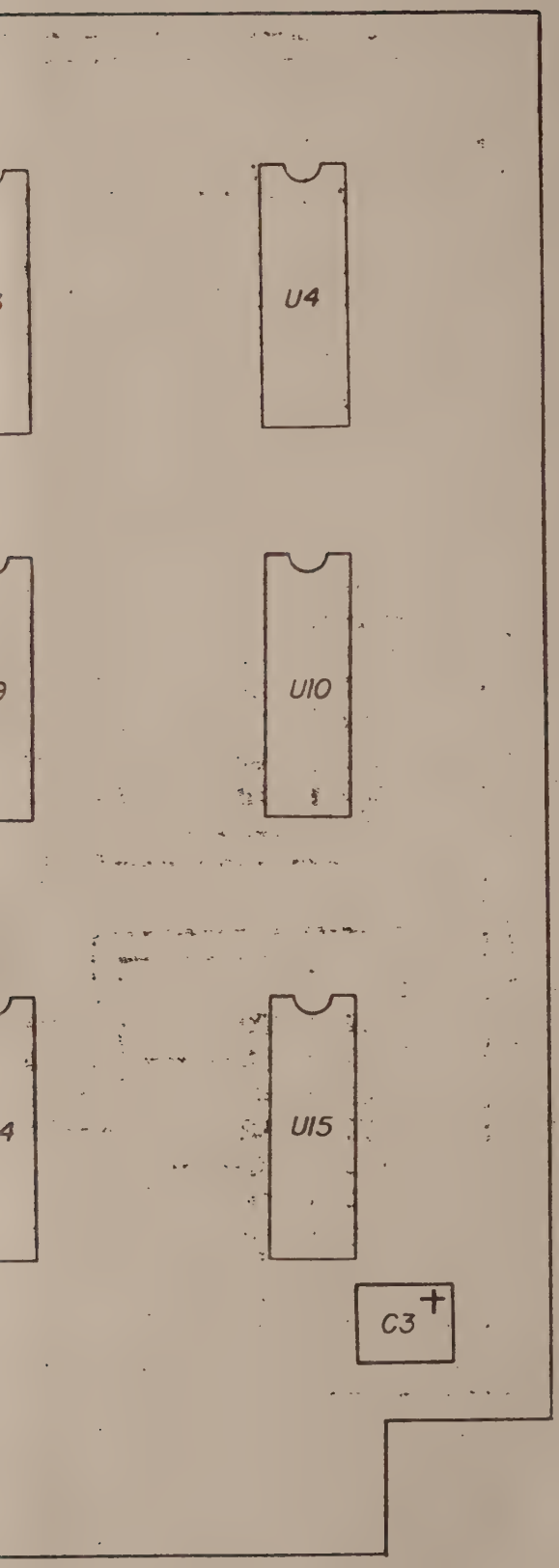


U1,5 ——— 7473
U2-4,7,9,10 — 8280
U6,11,13 ——— 7400
U8 ——— 7403
U12 ——— 7410
U14 ——— 74145
UNLESS OTHERWISE SPECIFIED
RESISTORS 1/4W 5%

REAL TIME RANGE		RTC	DAC
1 2 5	4	— — 200KHZ	100KHZ
1 2 5	3	100KHZ 50KHZ 20KHZ	10KHZ
1 2 5	2	10KHZ 5KHZ 2KHZ	1KHZ
1 2 5	1	1KHZ 500HZ 200HZ	100HZ

	CLOCK	
CURRENT ECO	625-047	
	USED: 502	
BD REV	11-21-77	TV
C	AUTEK SYSTEMS CORP	


2MHZ X-TAL
R2
R1
R5
C2
R3
C5
C4
C6
C1
R4
U1
R11
R6
U2
Q1
C2
U5
R15
U6
U7
R12
U8
R13
U11
U12
R7
U13
R10
R9
R8
R14
C7



CLOCK
625-047C

PIN	SIGNAL	CONNECTION
A	+15V	Buss
B	SEG	A5-10,A6-T,A7-$\overline{E}$,A9-L
C	+5V	Buss
D	TR "8"	A10-M,B5-$\overline{C}$,S214-8
E	TR "1"	A10-L,B5-25,S214-1
F	RT↑	A6-25,A7-25,A1-19
H		
J		
K		
L		
M		
N		
P		
R	GND	Buss
S		
T	DRC	A7-24
U	RTC	A10-4
V		
W		
X		
Y		
Z		

A8, CLOCK
625-047

PIN	SIGNAL	CONNECTION
$\overline{A}$	T Mult "2"	A6-L,B5-$\overline{F}$,S213-1
$\overline{B}$	T Mult "4"	A6-M,B5-28,S213-2
$\overline{C}$	2 MHz	A6-$\overline{C}$
$\overline{D}$	+150V	Buss
$\overline{E}$	200 Bias	A7-27
$\overline{F}$	-15V	Buss

PIN	SIGNAL	CONNECTION
1		
2		
3		
4	TR "4"	A10-N,B5-26,S214-4
5	TR "2"	A10-K,B5-$\overline{D}$,S214-2
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		

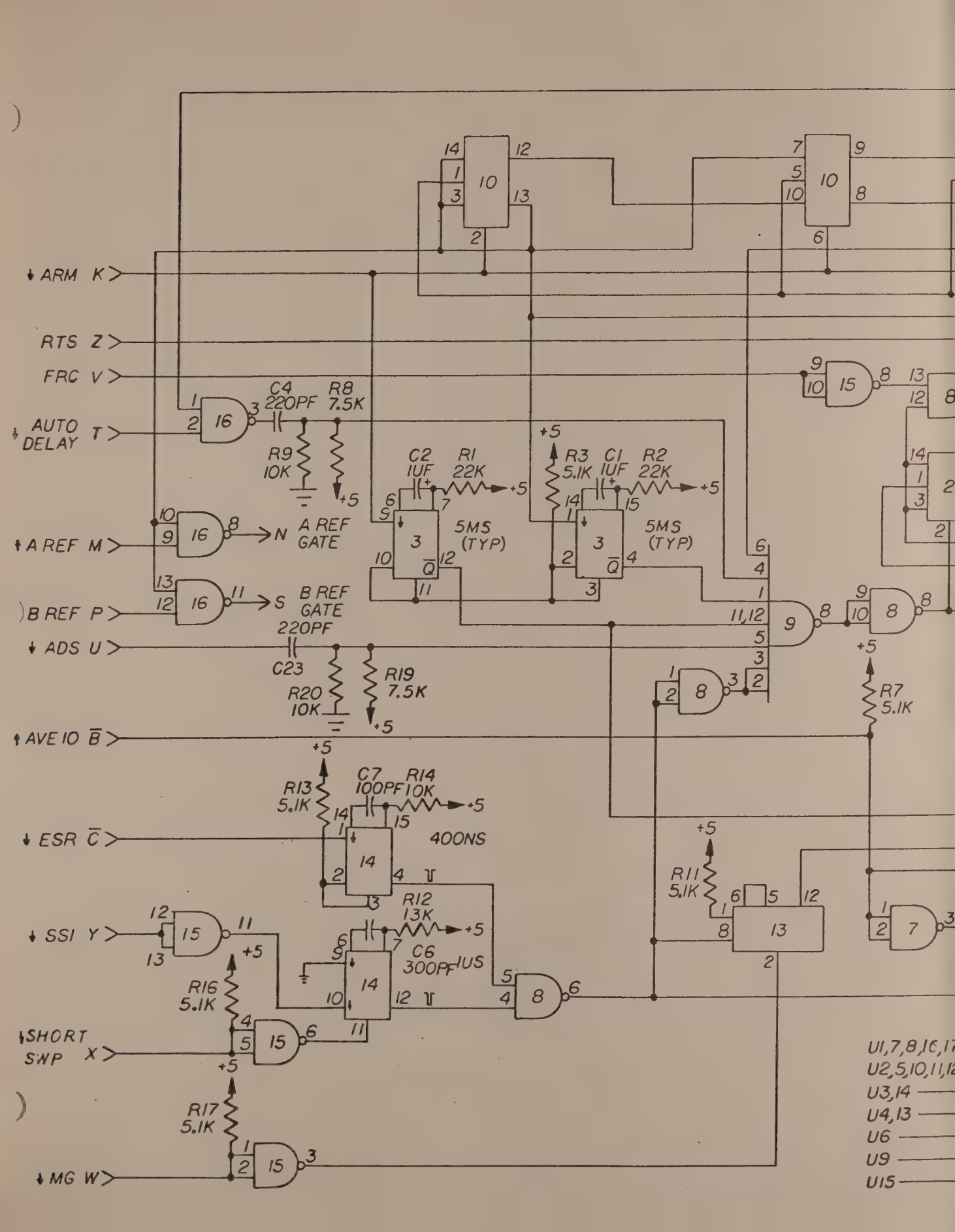
A8, CLOCK
625-047

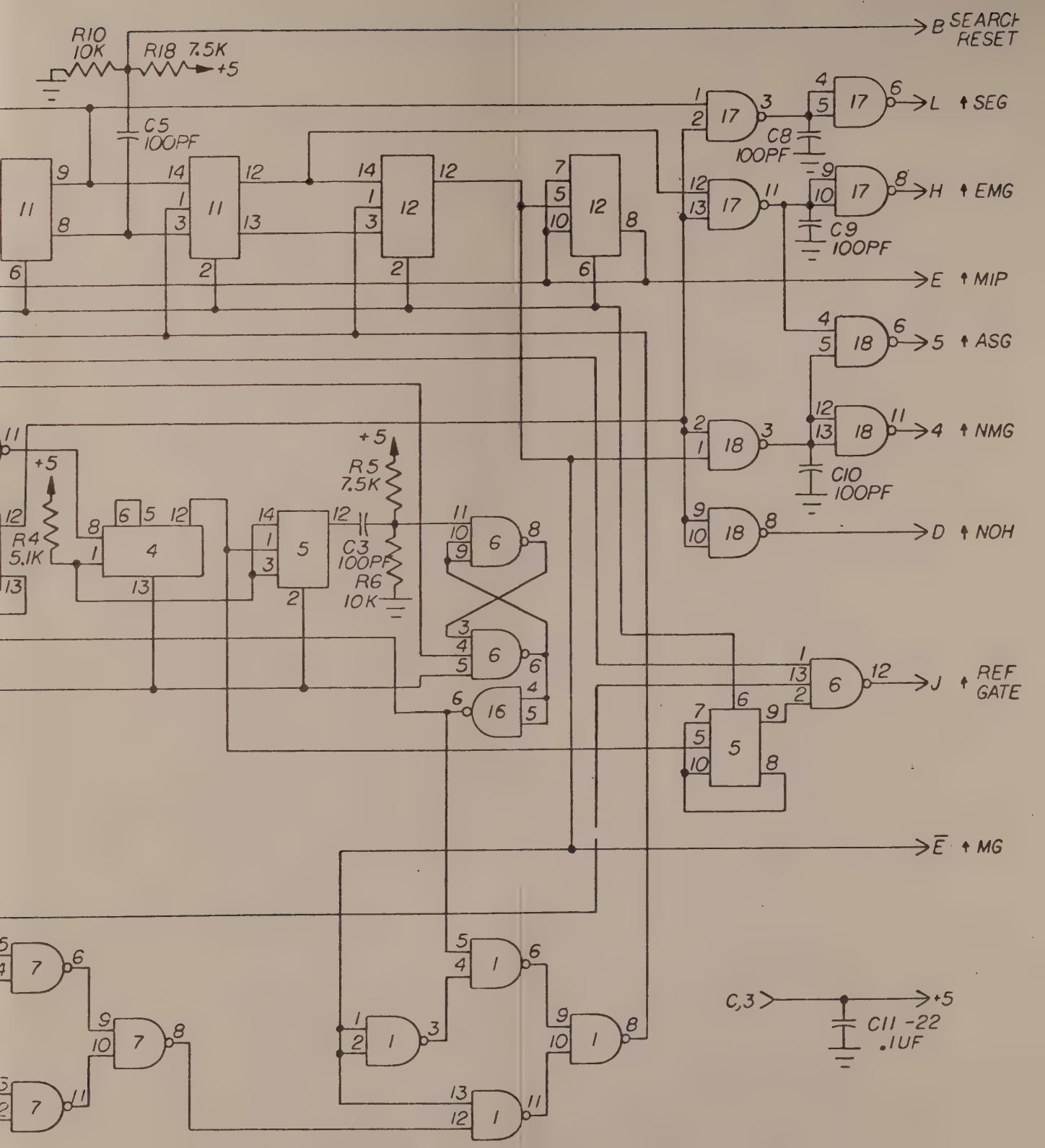
PIN	SIGNAL	CONNECTION
23		
24		
25		
26		
27	NOH	A9-D,A6-W,A7-22
28		

TITLE	USED ON	B/M	
Clock	502	625-047	E

PREP DATE	CHG	CHG TITLE	CHG DATE	PAGE	OF
6-17-75				1	1

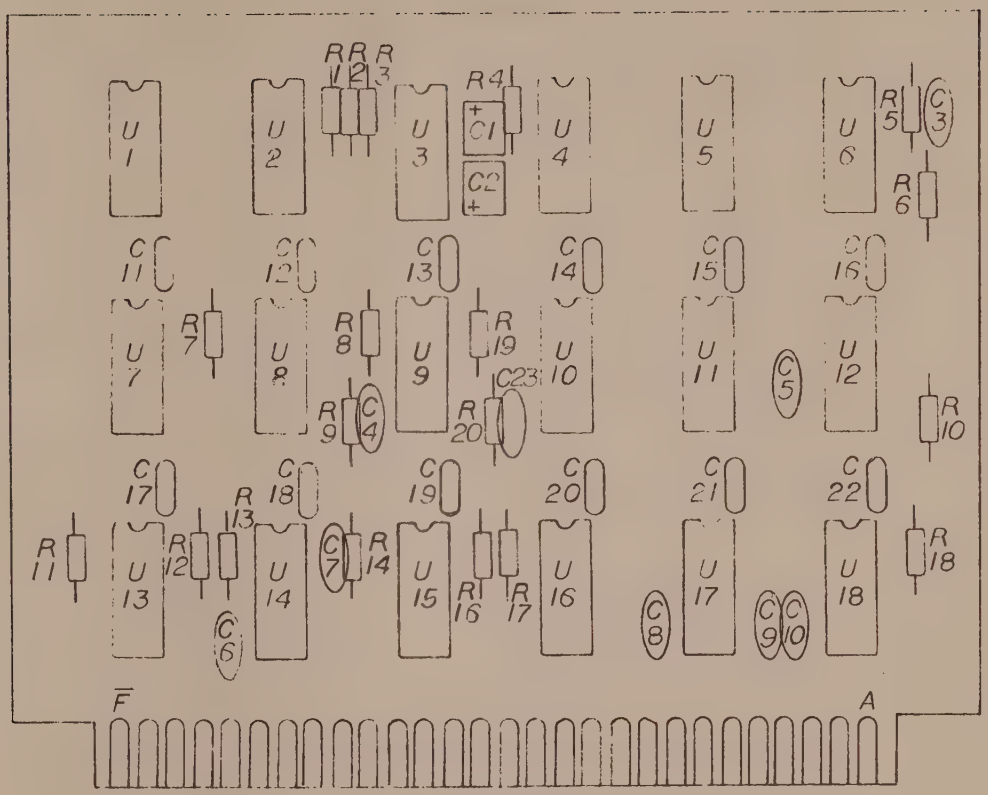
ITEM	ASSEMBLY OR PART NO.	DESCRIPTION	SCHEM. REF.	QTY	UNIT COST	EXT. COST
1	102-010	10 ohm 1/4W 5% Res	R 1	1		
2	102-102	1k 1/4W 5% Res	R 5,6	2		
3	102-334	330k 1/4W 5% Res	R 4	1		
4	102-392	3.9k 1/4W 5% Res	R 15	1		
5	102-511	510 ohm 1/4W 5% Res	R 12	1		
6	102-512	5.1k 1/4W 5% Res	R 7-11,13	6		
7	102-622	6.2k 1/4W 5% Res	R 14	1		
8	102-752	7.5k 1/4W 5% Res	R 2,3	2		
9	131-151	150pF Cap	C 4	1		
10	131-330	33pF Cap	C 5	1		
11	131-820	82pF Cap	C 6	1		
12	133-102	.001uF Disc Cap	C 7	1		
13	137-105	1uF 50V Cap	C 1-3	3		
14	150-364	2N3646	Q 1,2	2		
15	171-700	MC7400	IC 6,11,13 15	4		
16	171-703	MC7403	IC 8	1		
17	171-710	MC7410	IC 12	1		
18	171-745	MC74145	IC14	1		
19	171-773	MC7473	IC 1,5	2		
20	171-880	8280	IC 2-4,7,9, 10	6		
21	182-002	Crystal 2MHz	Y 1	1		
22	525-047	P.C. board	---------	1		


ARM K
RTS Z
FRC V
AUTO DELAY T
A REF M
B REF P
ADS U
AVE IO B
ESR C
SSI Y
SHORT SWP X
MG W
C4 220PF
R8 7.5K
R9 10K
C2 1UF
R1 22K
R3 5.1K
C1 1UF
R2 22K
5MS (TYP)
A REF GATE
B REF GATE
C23 220PF
R20 10K
R19 7.5K
R7 5.1K
R13 5.1K
C7 100PF
R14 10K
400NS
R12 13K
C6 300PF
1US
R11 5.1K
R16 5.1K
R17 5.1K
+5
U1,7,8,16,17
U2,5,10,11,12
U3,14
U4,13
U6
U9
U15



UNLESS OTHERWISE NOTED
RESISTORS ARE
1/4W 5%

CONTROL LOGIC
625-054
2-24-77 VB
AUTEK SYSTEMS



CONTROL LOGIC
625-054D

PIN	SIGNAL	CONNECTION
A		
B	Search Fail Reset	A7-D
C	+5V	Buss
D	NOH	A6-W,A7-22,A8-27
E	MIP	A1-F
F		
H	EMG	A6-Y
J	Ref Gate	A5-15,J105-44
K	ARM	A1-B,A5-16,A7-D
L	SEG	A5-10,A7-$\overline{E}$,A6-T,A8-B
M	A Ref Prog	J105-38
N	"A" Ref Gate	J102-A,J106-3
P	B Ref Prog	J105-39
R	GND	Buss
S	B Ref Gate	J103-A,J106-11
T	↑N/A↓	A5-V
U	ADS	A5-11
V	FRC	A2-15,A7-$\overline{A}$,A6-27,A10-F,A5-12
W	MG↓	J105-41
X	Short Sweep↓	J105-40
Y	SSI	J105-6
Z	RTS	A10-Y

PIN	SIGNAL	CONNECTION
$\overline{A}$		
$\overline{B}$		
$\overline{C}$	ESR	A6-N
$\overline{D}$		
$\overline{E}$	MG↑	J105-2
$\overline{F}$		

PIN	SIGNAL	CONNECTION
1		
2		
3		
4	NMG	A1-S,A6-U
5	ASG	A7-4,A7-23
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		

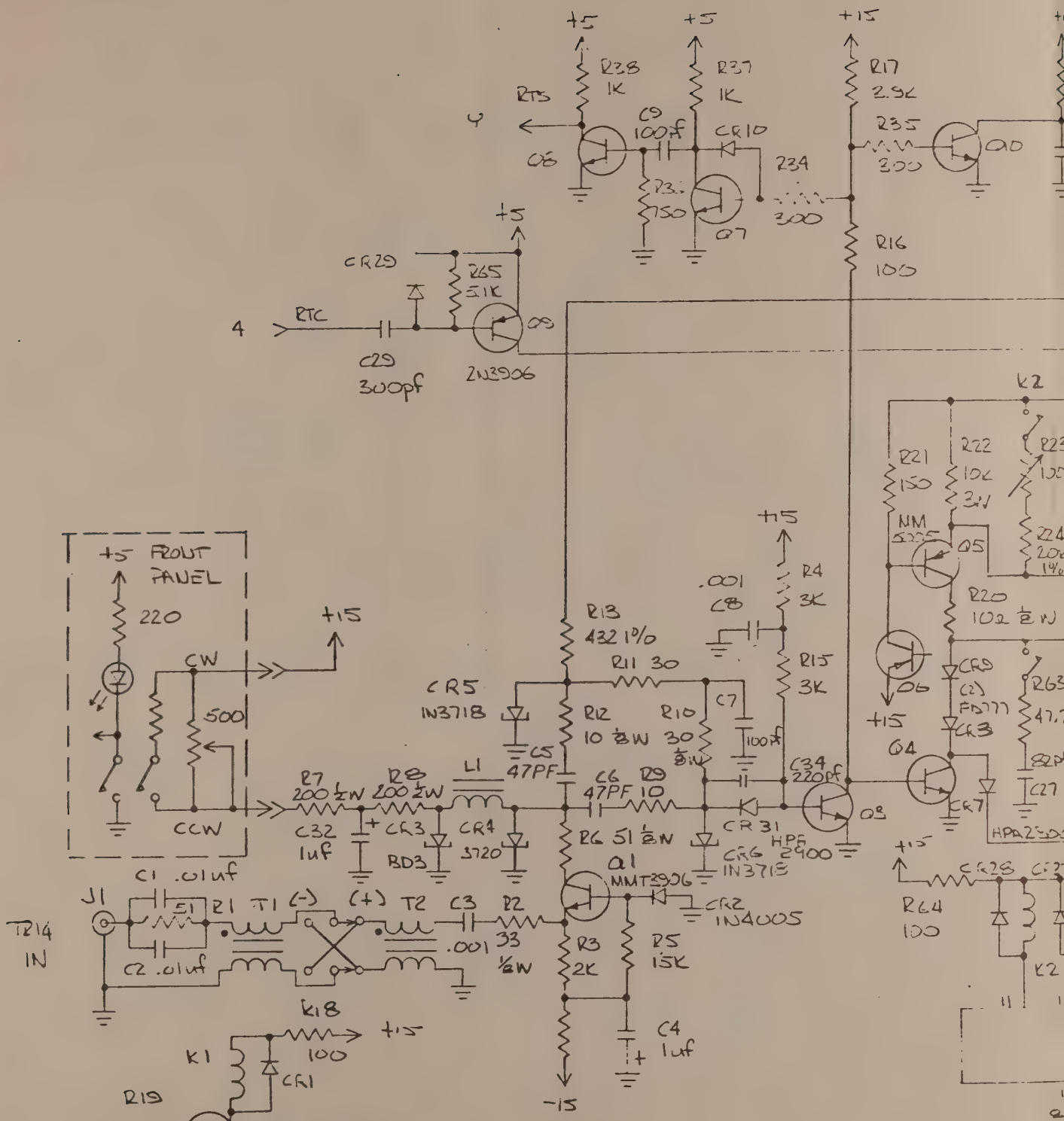
PIN	SIGNAL	CONNECTION
23		
24		
25		
26		
27		
28		

TITLE		USED ON	B/M 625-054	G
Control Logic		502		
PREP DATE: REB 6-20-75	CHK DATE	REL DATE	PAGE 1 OF 1	REV.

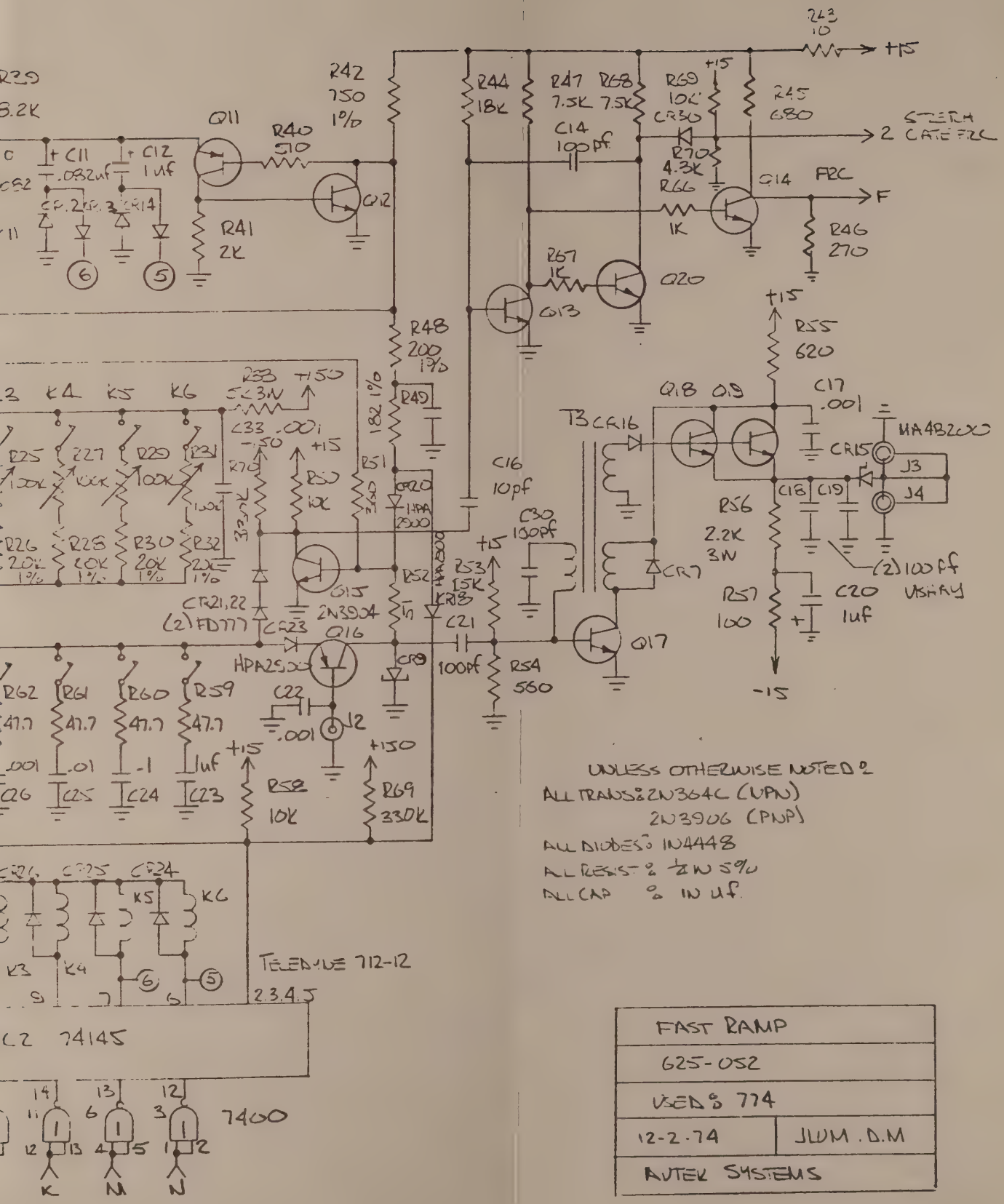
ITEM	ASSEMBLY OR PART NO	DESCRIPTION	SCHEM. REF.	QTY ASSY	REQ'D	UNIT COST	UNIT	EXTENSION	SHORT
1	102-103	10k 1/4 W 5% Resistor	R20,6,9,10 14	5					
2	102-133	13k " " "	R12	2					
3	102-223	22k " " "	R1,2	2					
4	102-512	5.1k " " "	R3,4,7,11, ~~16,17,13~~	7					
5	102-752	7.5k " " "	R5,8,18,19	4					
6	131-101	100 pF Cap	C10,3,5,7, 8,9	6					
7	131-301	300 pF Cap	C6	1					
8	131-221	220 pF Cap	C4,23	2					
9	133-104	.1 μ F Cap 50 V	C11-22	12					
10	137-105	1 μ F Cap	C2,1	2					
11	171-123	74123 I. C.	U3,14	2					
12	171-132	74132 I. C.	U15	1					
13	171-700	7400 I. C.	16,17,18 U1,7,8,	6					
14	171-710	7410 I. C.	U6	1					
15	171-730	7430 I. C.	U9	1					
16	171-773	7473 I. C.	U2,5,12,11,10	5					
17	171-880	8280 I. C.	U4,13	2					
18	525-054	P. C. Board		1					

B/M

REVISIONS:

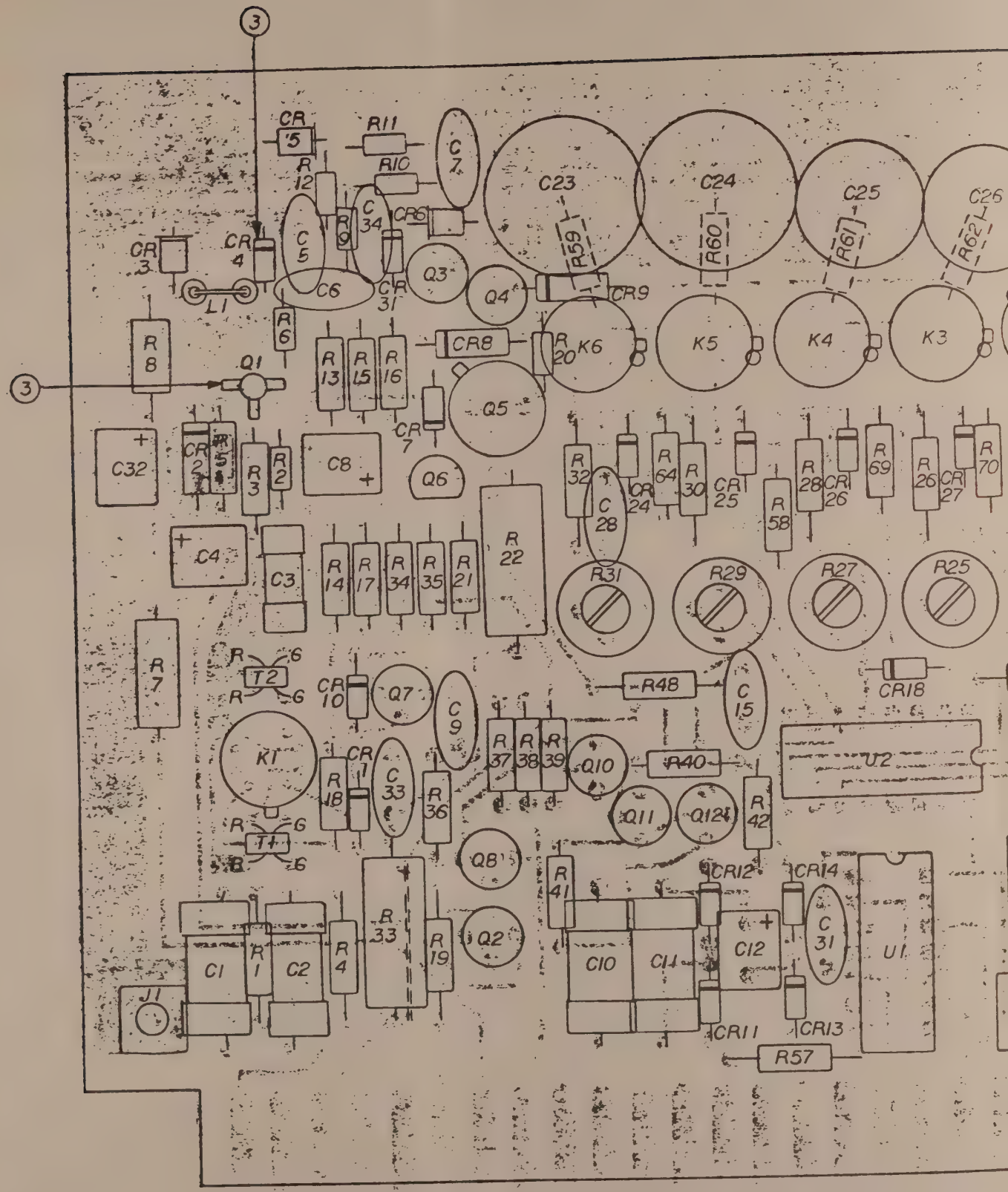

+5
+15
R38 1K
R37 1K
R17 2.5K
R35 300
Q6
Q8
Q7
C9 100pf
CR10
R34 300
R16 100
CR29
R65 5.1K
Q9
RTC
C29 300pf
2N3906
K2
R21 150
R22 10K 3W
NM 5225
Q5
R20 10Ω ½W
R4 3K
.001 C8
R13 432 1%
R11 30
R15 3K
CR5 IN3718
R12 10 ½W
R10 30 ½W
C7 100pf
C5
L1 47PF
C6 47PF
R9 10
C34 220pf
Q4
Q3
CR31 HPA 2900
CR6 IN3713
R6 51 ½W
Q1 MMT2906
CR2 IN4005
R7 200 ½W
R8 200 ½W
C32 1uf
CR3
CR4 3720
BD3
+5 FRONT PANEL
220
CW
CCW
500
C1 .01uf
J1
R1 51
T1
T2
C3 .001
R2 33 ½W
C2 .01uf
R3 2K
R5 15K
C4 1uf
K18
K1
CR1
R19 2.7K
Q2 2N3904
100
-15
R64 100
CR28
TR14 IN

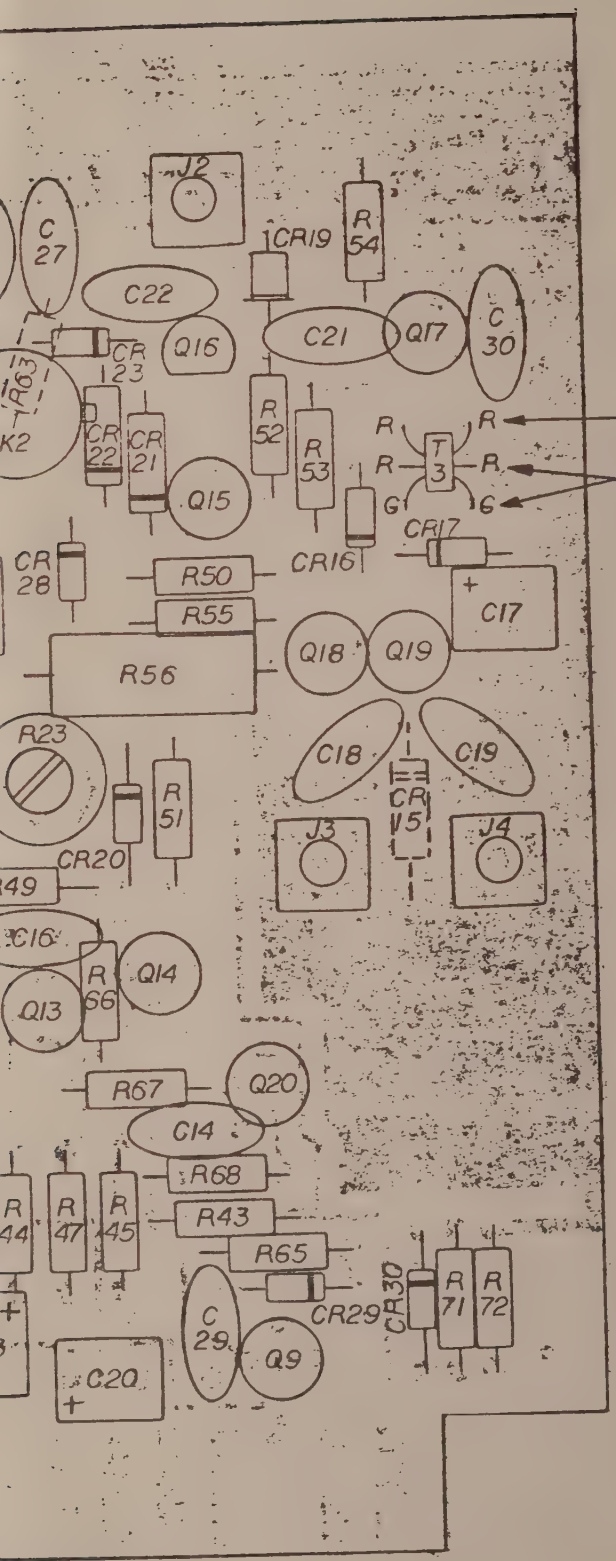
9.10



UNLESS OTHERWISE NOTED:
ALL TRANS: 2N3640 (NPN)
2N3906 (PNP)
ALL DIODES: IN4448
ALL RESIST: ±W 5%
ALL CAP: IN uf

FAST RAMP	
625-052	
USED: 774	
12-2-74	JWM . D.M
AUTEK SYSTEMS	


3
CR 5
R11
R10
C 7
R 12
C 34
CR6
C23
C24
C25
C26
R59
R60
R61
R62
CR 3
CR 4
C 5
C6
R 9
CR 31
Q3
Q4
CR9
L1
R 6
R 8
Q1
R 13
R 15
R 16
CR8
R 20
K6
K5
K4
K3
CR 7
Q5
C32
CR 2
R 5
R 3
R 2
C8
Q6
R 32
C 28
CR 24
R 64
R 30
CR 25
R 58
R 28
CR 26
R 69
R 26
CR 27
R 70
C4
C3
R 14
R 17
R 34
R 35
R 21
R 22
R31
R29
R27
R25
R 7
R
6
T2
R
6
CR 10
Q7
C 9
R48
C 15
CR18
K1
CR 1
R 18
C 33
R 36
R 37
R 38
R 39
Q10
R40
U2
Q11
Q12
R 42
R
6
T1
R
6
Q8
R 41
CR12
CR14
C1
R 1
C2
R 4
R 33
R 19
Q2
C10
C11
C12
C 31
U1
J1
CR11
CR13
R57



NOTES:

(1) SINGLE WIRE, 3 TURNS

(2) BIFILAR WIRE, 6 TURNS

(3) Q1 AND CR4 INSTALLED BY TEST

	FAST RAMP
CURRENT ECO	625-052B
	USED ON: 502
BD REV	6-14-77
B	AUTEK SYSTEMS CORP.

A10, FAST RAMP
625-052

PIN	SIGNAL	CONNECTION
A	+15V	Buss
B		
C	+5V	
D		
E		
F	FRC	A1-15,A7-$\overline{A}$,A5-12,A6-27,A9-V
H		
J		
K	TR"2"	A8-5,B5-$\overline{D}$,S214-2
L	TR"1"	A8-E,B5-25,S214-1
M	TR"4"	A8-D,B5-$\overline{C}$,S214-8,J105-10
N	TR"8"	A8-4,B5-26,S214-4,J105-9
P		
R	GND	Buss
S		
T		
U		
V		
W		
X		
Y	RTS	A9-Z
Z	Trg. Level	R207-1,2

A10, FAST RAMP
625-052

PIN	SIGNAL	CONNECTION
$\overline{A}$	Trig Pol.	B5-2,S218-1
$\overline{B}$		
$\overline{C}$		
$\overline{D}$	+150V	Buss
$\overline{E}$		
$\overline{F}$	-15V	Buss

PIN	SIGNAL	CONNECTION
1		
2	Str Gate FRC	A3-25,A4-25
3		
4	RTC	A8-U
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		

A10, FAST RAMP
625-052

PIN	SIGNAL	CONNECTION
23		
24		
25		
26		
27		
28		

TITLE	USED ON	B / M	
Fast Ramp Assy	502	625-052	F

PURPOSE	DATE	CHK	DATE	APP	DATE	PAGE 1 OF 4	REV
AGR	6-26-75						

ITEM	ASSEMBLY OR PART NO	DESCRIPTION	SCREEN REF	REQ'D	ISSUED	UNIT COST	RECEIVED	EXTENSION	SHORT
1	101-100	10 ohm 1/8w 5% Res	R9,12,20	3					
2	101-300	30 ohm 1/8w 5% Res	R10	1					
3	101-330	33 ohm 1/8w 5% Res	R2,11	2					
4	101-510	51 ohm 1/8w 5% Res	R6	1					
5	102-100	10 ohm 1/4w 5% Res	R43	1					
6	102-101	100 ohm 1/4w 5% Res	R4,16,18,57,64	5					
7	102-102	1 k 1/4w 5% Res	R37,38,66,67	4					
8	102-103	10 k 1/4w 5% Res	R39,50,58,71	4					
9	102-153	15 k 1/4w 5% Res	R5,53	2					
10	102-154	150 k 1/4w 5% Res	R21	1					
11	102-183	18 k 1/4w 5% Res	R44	1					
12	102-202	2 k 1/4w 5% Res	R3,41	2					
13	102-271	270 ohm 1/4w 5% Res	R46	1					
14	102-272	2.7 k 1/4w 5% Res	R19	1					
15	102-301	300 ohm 1/4w 5% Res	R34,35	2					
16	102-302	3 k 1/4w 5% Res	R14,15	2					
17	102-334	330 k 1/4w 5% Res	R69,70	2					
18	102-361	360 ohm 1/4w 5% Res	R51	1					
19	102-392	3.9 k 1/4w 5% Res	R17	1					
20	102-432	4.3 k 1/4w 5% Res	R72	1					
21	102-510	51 ohm 1/4w 5% Res	R1,52	2					
22	102-511	510 ohm 1/4w 5% Res	R40	1					
23	102-512	5.1 k 1/4w 5% Res	R65	1					
24	102-561	560 ohm 1/4w 5% Res	R54	1					
25	102-621	620 ohm 1/4w 5% Res	R55	1					
26	102-681	680 ohm 1/4w 5% Res	R45	1					

TITLE: Fast Ramp Assy | USED ON: 502 | B/M 625-052 | F

AGR 04 6-26-75 | PAGE 2 OF 4 | REV

ITEM	ASSEMBLY OR PART NO	DESCRIPTION	SCHEM REF	QTY	COST		REV
27	102-751	750 ohm 1/4w 5% Res	R36	1			
28	102-752	7.5 k 1/4w 5% Res	R47,68	2			
29	103-201	200 ohm 1/2w 5% Res	R7,8	2			
30	103-222	2.2 k 1/2w WW 5% Res	R56	1			
31	107-166	47.5 ohm 1/8w 1% Res	R59-63	5			
32	107-226	182 ohm 1/8w 1% Res	R49	1			
33	107-230	200 ohm 1/8w 1% Res	R48	1			
34	107-262	432 ohm 1/8w 1% Res	R13	1			
35	107-430	20 k 1/8w 1% Res	R24,26,28, 30,32	5			
36	108-285	750 ohm 1/4w 1% Res	R42	1			
37	114-103	10 k 3w WW 5% Res	R22	1			
38	114-402	4k 3W WW 5% Res	R33	1			
39	125-104	100 k A/B SV1041 Pot	R23,25,27, 29,31	5			
40	131-100	10 pF Dip Mica Cap	C16	1			
41	131-101	100 pF Dip Mica Cap	C9,18,19,21, 30	5			
42	131-201	200 pF Dip Mica Cap	C14	1			
43	131-221	220 pF Dip Mica Cap	C34	1			
44	131-301	300 pF Dip Mica Cap	C7,29	2			
45	131-470	47 pF Dip Mica Cap	C5,6	2			
46	131-471	470 pF Dip Mica Cap	C15	1			
47	131-820	82 pF Dip Mica Cap	C27	1			
48	133-102	.001 uF Disc Cap	C22,28,31, 33	4			
49	135-102	.001 uF 200V Film Cap	C3	1			
50	135-103	.01 uF 200V Film Cap	C1,2	2			
51	135-822	.0082 uF 200V Film Cap	C10	1			
52	135-823	.082 uF 200V Film Cap	C11	1			

TITLE		502	P / M 625-052	F
Fast Ramp Assy				
	DATE CH		PAGE 3 OF 4	
6-26-75				

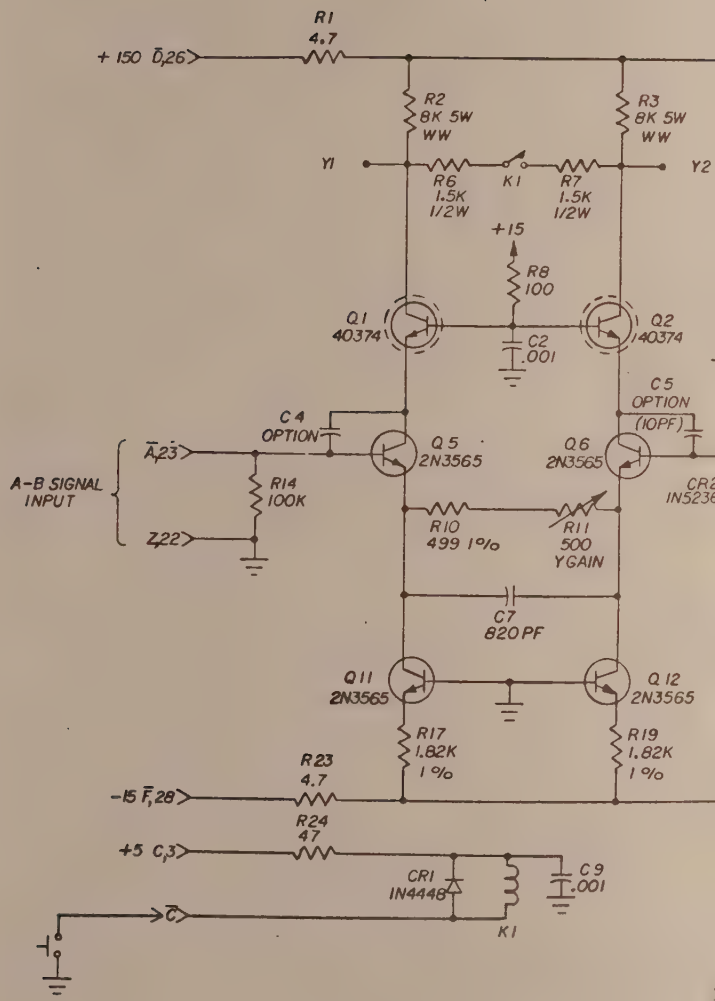
ITEM	ASSEMBLY OR PART NO	DESCRIPTION			SCHEM REF	QTY	QTY	UNIT COST		EXTENSION	CHK
53	136-101	.001 uF	600V	Cap	C26	1					
54	136-102	.01 uF	100V	Cap	C25	1					
55	136-103	.1 uF	50V	Cap	C24	1					
56	136-104	1 uF	50V	Cap	C23	1					
57	137-105	1 uF	50V Tantalum	Cap	C4,8,12,13, 17,20,32	7					
58	150-364	2N3646	NPN	Trnstr	Q3,7,8,10, 12-14,17-20	11					
59	150-390	2N3904	NPN	Trnstr	Q2,15	2					
60	151-390	2N3906	PNP	Trnstr	Q6,9,11,16	4					
61	151-558	2N5583	PNP	Trnstr	Q5	1					
62	155-396	MMT3960	NPN	Trnstr	Q1	1					
63	160-077	FD777	(FSC)	Diode	D8,9,21,22	4					
64	160-400	1N4005		Diode	D2	1					
65	160-444	1N4448		Diode	D1,10-14,16, 24-30	14					
66	166-003	BD3	GE Back	Diode	D3	1					
67	166-264	TD264	22mA	TD	D4	1					
68	166-318	1N3718	10mA	TD	D5,6,19	3					
69	167-290	HP5082-2900		Diode	D7,17,18,20, 23,31	6					
70	167-420	M/A	44300	Diode	D15	1					
71	171-700	MC7400 P		IC	IC 1	1					
72	171-746	MC74145P		IC	IC 2	1					
73	184-002	DPDT Relay, Teledyne 712-12			K1-6	6					
74	200-209	Connector, Min. Coax			J1-4	4					
75	525-052	P.C. Board			-----	1					
76	630-002	Transformer, 6T Torroid			T1,2	2					
77	630-004	Transformer, B.O.			T3	1					
78	630-005	Coil (1 turn, 2 beads)			L1	1					

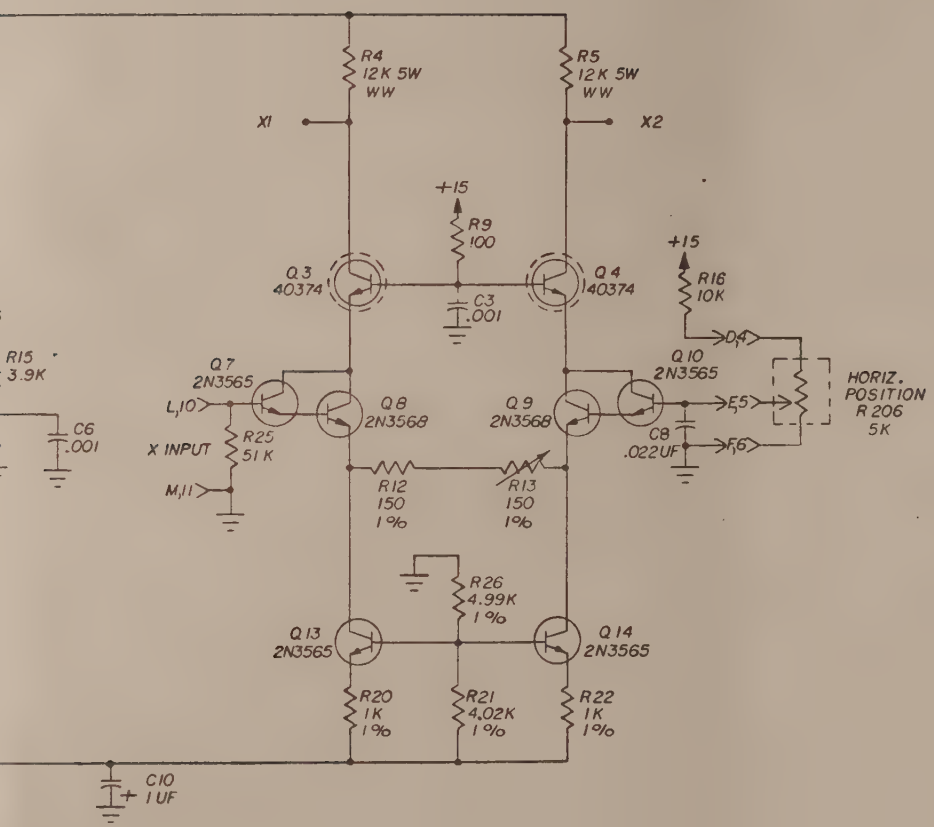
TITLE	USED ON	B/M 625-052	F
Fast Ramp Assembly	502		
PREP RPB DATE 6/26/75 CH DATE	REL DATE	PAGE 4 OF 4	REV

ITEM	ASSEMBLY OR PART NO	DESCRIPTION	SCHEM. REF.	QTY ASSY	ISS'D	UNIT COST	UNIT	EXTENSION	CHG.
79	150-353	2N3563 Transistor	Q4	1					

B/M

REVISIONS:

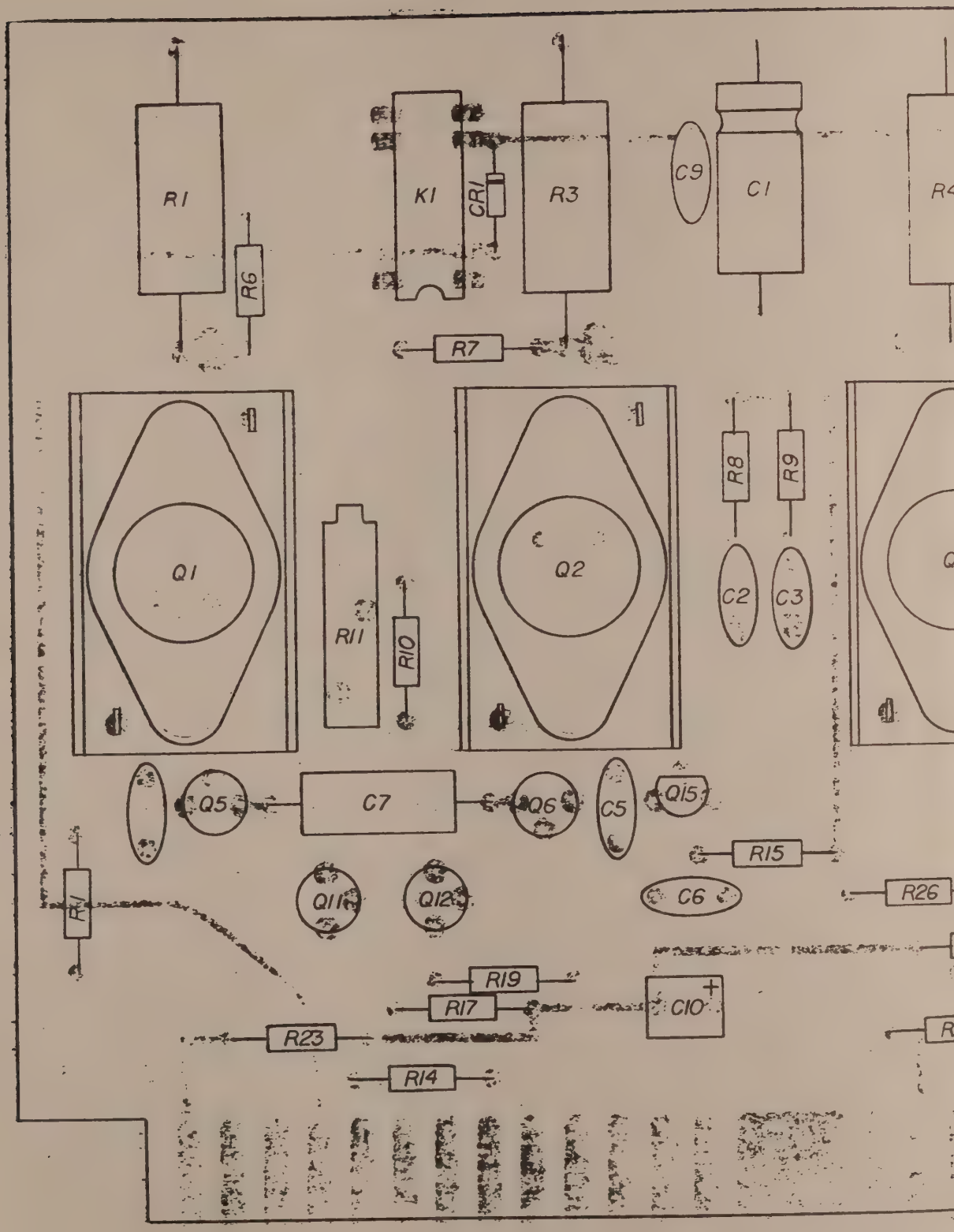

R1
4.7
+ 150 D,26>
R2
8K 5W
WW
R3
8K 5W
WW
Y1
R6
1.5K
1/2W
K1
R7
1.5K
1/2W
Y2
+15
R8
100
Q1
40374
Q2
40374
C2
.001
C5
OPTION
(10PF)
C4
OPTION
A,23>
Q5
2N3565
Q6
2N3565
A-B SIGNAL
INPUT
R14
100K
Z,22>
R10
499 1%
R11
500
YGAIN
C7
820 PF
Q11
2N3565
Q12
2N3565
R17
1.82K
1%
R19
1.82K
1%
R23
4.7
-15 F,28>
R24
47
+5 C,3>
CR1
IN4448
C9
.001
C>
K1

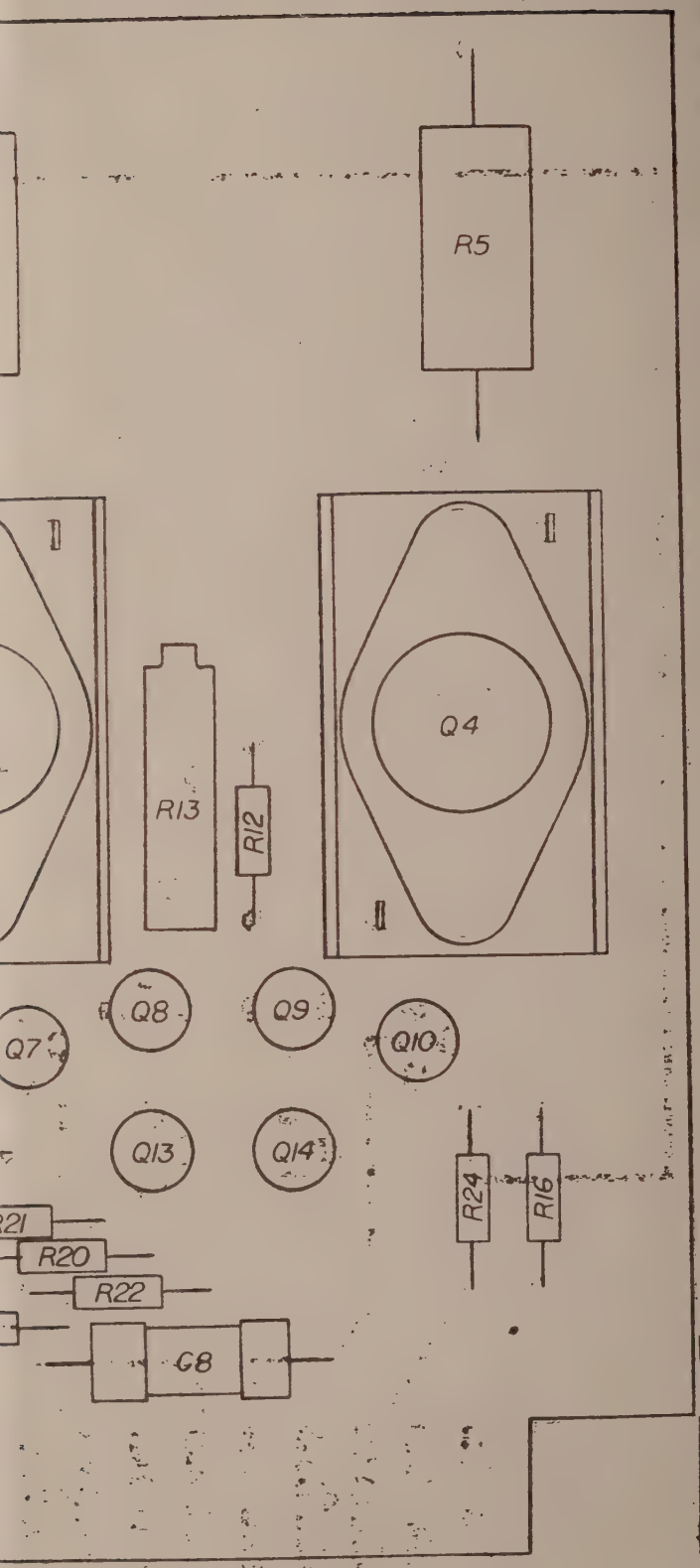


ILESS OTHERWISE SPECIFIED ALL
ESISTORS 1/4W 5%

ILESS OTHERWISE SPECIFIED ALL
PACITORS VALUES ARE IN MICRO-
RADS

	X-Y AMPLIFIER	
CURRENT ECO	625-044	
35	USED: 774	
BD REV	9 13 77	RS
B	AUTEK SYSTEMS CORP.	


R1
R6
K1
CR1
R3
R7
C9
C1
R4
Q1
R11
R10
Q2
R8
R9
C2
C3
Q5
C7
Q6
C5
Q15
R15
C6
R26
Q11
Q12
R19
R17
C10
R23
R14



NOTES: (1) BEFORE LOADING BESURE TRANSISTOR HEATSINK MOUNTING HOLES ARE CORRECT SIZE (8 PLACES)

	X-Y AMPLIFIER	
CURRENT ECO	625044	
35	USED: 504	
BD REV	8-8-77	RS
B	AUTEK SYSTEMS CORP.	

PIN	SIGNAL	CONNECTION
A	+15V	Buss
B		
C	+5V	Buss
D	Horz. Pos.	R206-1
E	Horz Pos.	R206-2
F	GND	
H		
J		
K		
L	X-Input	A6-K
M	GND	
N		
P	GND	Buss
R	GND	Buss
S	GND	Buss
T		
U		
V		
W		
X		
Y		
Z	GND	

B1, X-Y AMPLIFIER
625-044

PIN	SIGNAL	CONNECTION
$\overline{A}$	A-B Sig IN	A1-M
$\overline{B}$		
$\overline{C}$	Beam Finder	S219-1
$\overline{D}$	+150V	Buss
$\overline{E}$		
$\overline{F}$	-15V	Buss

PIN	SIGNAL	CONNECTION
1	+15V	Buss
2		
3	+5V	Buss
4		
5		
6		
7		
8		
9		
10		
11		
12		
13	GND	Buss
14	GND	Buss
15	GND	Buss
16		
17		
18		
19		
20		
21		
22		

Bl, X-Y AMPLIFIER
625-044

PIN	SIGNAL	CONNECTION
23		
24		
25		
26	+150V	Buss
27		
28	-15V	Buss

X-Y Amplifier		502	B/M 625-044		F
REB 6-20-75	6/30/75			1 of 2	

1	102-	4.7 ohm 1/4w 5% Res	R1,23	2	
2	102-101	100 ohm 1/4w 5% Res	R 8,9	2	
3	102-103	10 k 1/4w 5% Res	R16	1	
4	102-104	100 k 1/4w 5% Res	R14	1	
5	102-392	3.9 k 1/4w 5% Res	R15	1	
6	102-470	47 ohm 1/4w 5% Res	R24	1	
7	102-513	51 k 1/4w 5% Res	R25	1	
8	107-359	4.02K 1/4w 1% Res	R21	1	
9	103-152	1.5 k 1/2w 5% Res	R6,7	2	
10	107-218	150 ohm 1/8w 1% Res	R12	1	
11	107-268	499 ohm 1/8w 1% Res	R10	1	
12	107-301	1 k 1/8w 1% Res	R20,22	2	
13	107-326	1.82 k 1/8w 1% Res	R17,19	2	
14	114-123	12 k 5W WW 5%	R4,5	2	
15	114-812	8 k 5W WW 5%	R2,3	2	
16	125-052	500 ohm 89PR Pot	R11,13	2	
17	131-010	10 pF (select intest) 5%	C4,5	2	
18	131-681	680 pF Cap	C7	2	
19	133-104	.1 uF Disc Cap	C2,3,6,9	4	
20	135-223	.022 uF 200V Cap	C8	1	
21	137-105	1 uF 50V Cap	C10	1	
22	138-010	1 uF 250V Cap	C1	1	
23	150-356	2N3565 Npn Trnstr	Q5-7,10-14	8	
24	150-357	2N3568 Npn Trnstr	Q8,9	2	
25					
26					

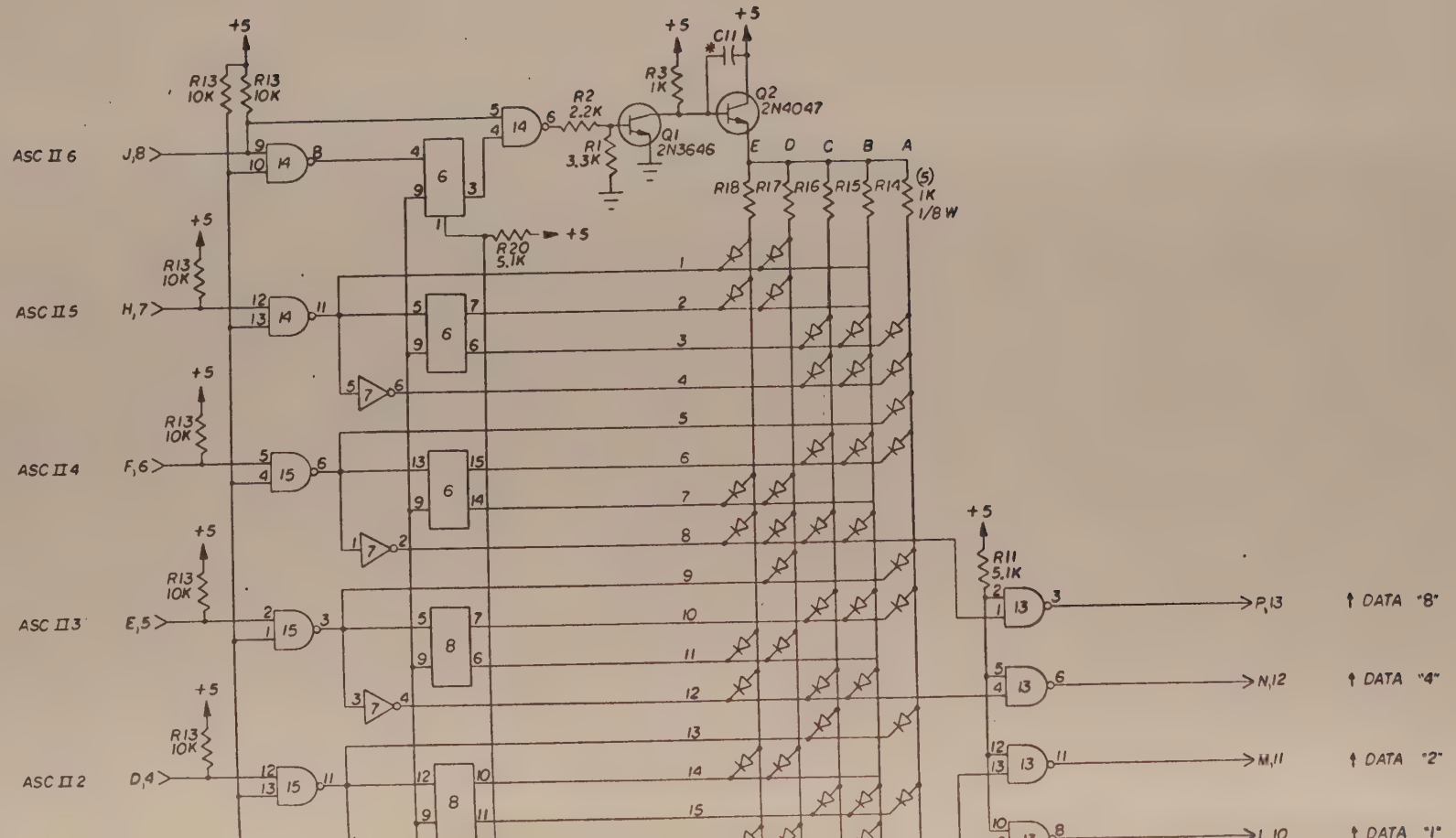
TITLE	USED ON	B/M	
X-Y Amplifier	502	625-044	F

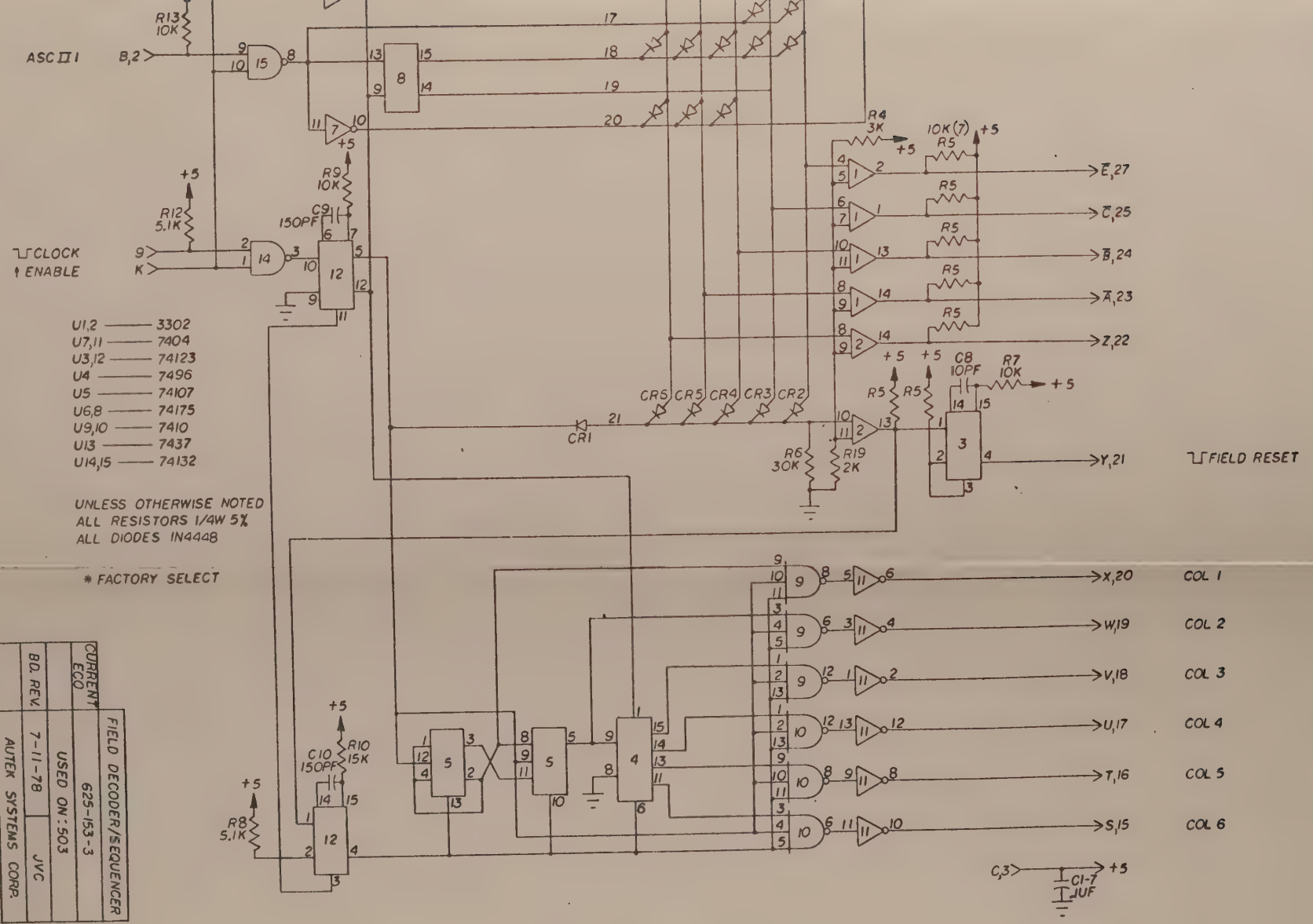
PREP DATE	CHK DATE	REL DATE	PAGE 2 OF 2 REV
REB 6-20-75	AJ2 6/30/75		

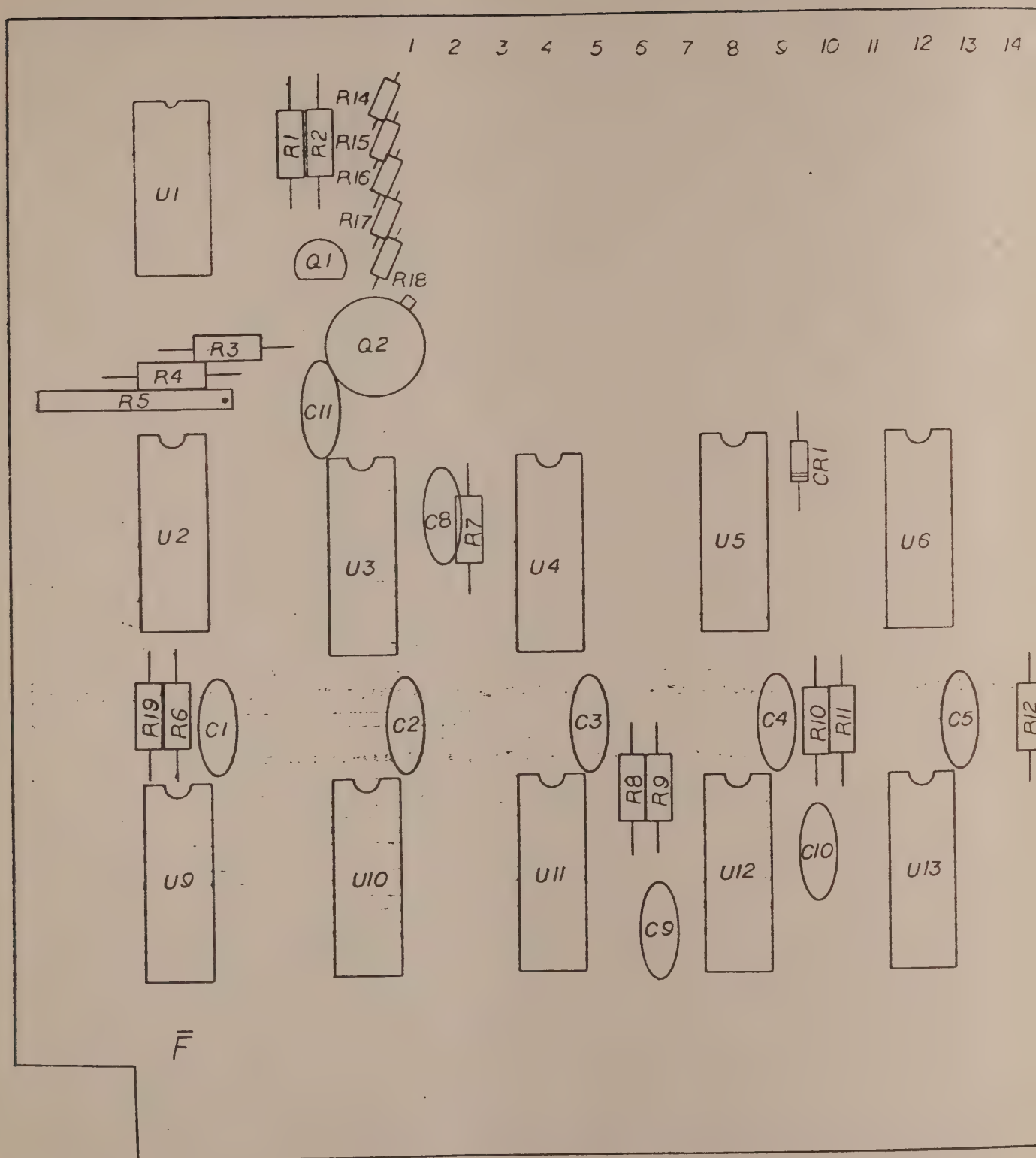
ITEM	ASSEMBLY OR PART NO	DESCRIPTION	SCHEM. REF.	QTY REQ'D	ISSUE	UNIT COST	DATE	EXTENSION	SHOP
27	160-444	IN4448 Diode	D1	1					
28	184-011	Relay, DLIA05	K1	1					
30	525-044	P.C. Board	-----	1					
31	107-368	4.99K 1/4w 1% Res	R26	1					

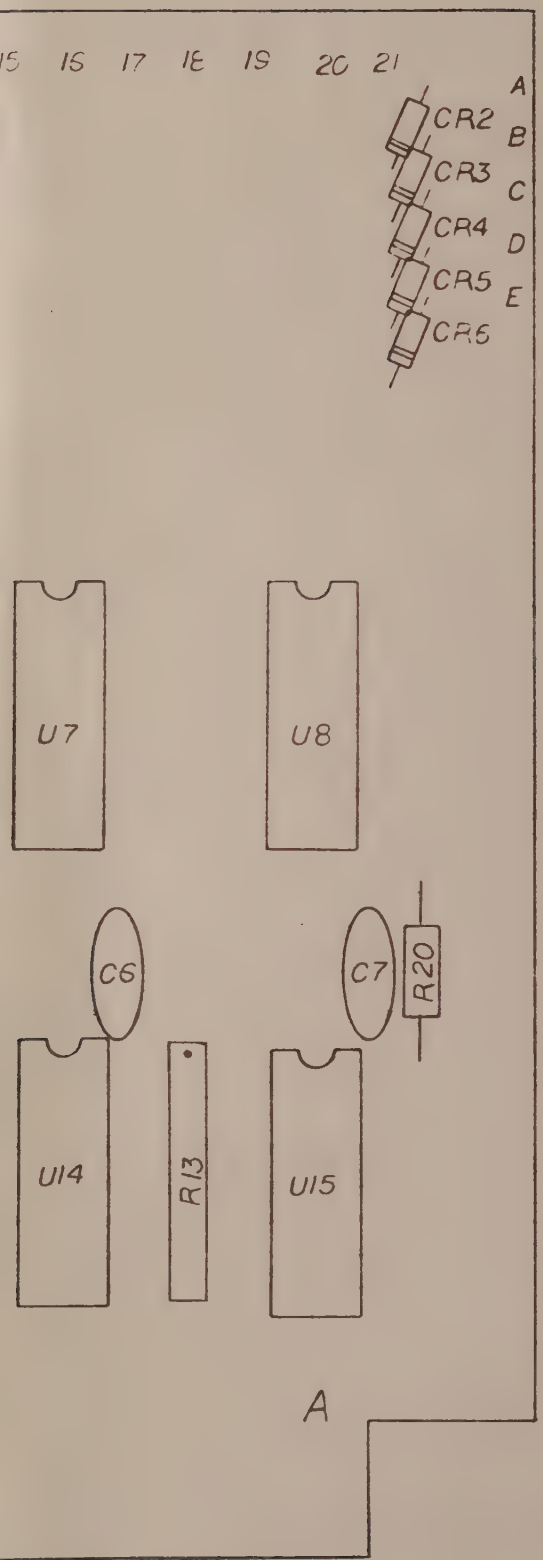
B/M

REVISIONS


+5
R13 10K
R13 10K
ASC II 6
J,8
ASC II 5
H,7
ASC II 4
F,6
ASC II 3
E,5
ASC II 2
D,4
R2 2.2K
R1 3.3K
Q1 2N3646
R3 1K
C11
Q2 2N4047
E D C B A
R18 R17 R16 R15 R14
(5) 1K 1/8 W
R20 5.1K
R11 5.1K
P,13
N,12
M,11
L,10
DATA "8"
DATA "4"
DATA "2"
DATA "1"


ASCII
B,2
R13 10K
CLOCK
ENABLE
K
R12 5.1K
R9 10K
C9 150PF
R8 5.1K
C10 150PF
R10 15K
R4 3K
R5
10K(7)
R6 30K
R19 2K
C8 10PF
R7 10K
CR1
CR5 CR5 CR4 CR3 CR2
E,27
C,25
B,24
A,23
Z,22
Y,21
FIELD RESET
X,20
W,19
V,18
U,17
T,16
S,15
COL 1
COL 2
COL 3
COL 4
COL 5
COL 6
C,3
C1-7 .1UF
U1,2 — 3302
U7,11 — 7404
U3,12 — 74123
U4 — 7496
U5 — 74107
U6,8 — 74175
U9,10 — 7410
U13 — 7437
U14,15 — 74132
UNLESS OTHERWISE NOTED
ALL RESISTORS 1/4W 5%
ALL DIODES IN4448
* FACTORY SELECT
FIELD DECODER/SEQUENCER
CURRENT ECO
625-153-3
BD. REV.
7-11-78
USED ON: 503
JVC
AUTEK SYSTEMS CORP.


1 2 3 4 5 6 7 8 9 10 11 12 13 14
U1
R1
R2
R14
R15
R16
R17
R18
Q1
Q2
R3
R4
R5
C11
U2
U3
C8
R7
U4
U5
CR1
U6
R19
R6
C1
C2
C3
C4
R10
R11
C5
R12
R8
R9
U9
U10
U11
U12
C10
U13
C9
F



DIODE MATRIX

	A	B	C	D	E
1			X		
2	X	X	X		
3					X
4	X	X			X
5					X
6					
7	X	X	X		X
8	X	X	X		
9					X
10			X		X
11	X	X			
12	X	X	X		
13		X	X		X
14					X
15	X	X	X		
16	X				
17	X				X
18					X
19	X	X	X		
20		X	X		
21	X	X	X		X

NOTES:

1. FOR EXAMPLE IN COLUMN ONE INSTALL DIODES IN ROWS ,C
2. ALL CATHODES TO NUMBERED P/C HOLE.
3. INSTALL DIODES PER MATRIX SHOWN ABOVE

	FIELD DECODER/SEQUENCER	
CURRENT ECO	625-153	
	USED: 502	
BD REV	7-19-77	DL
	AUTEK SYSTEMS CORP	

B2 FIELD DECODER/SEQUENCER
625-053

PIN	SIGNAL	CONNECTION
A	+15V	B6-1
B	ASCII 1	J104-1
C	+5V	Buss
D	ASCII 2	J104-2
E	ASCII 3	J104-3
F	ASCII 4	J104-4
H	ASCII 5	J104-13
J	ASCII 6	J104-14
K	Inhibit	J104-18
L	Data 1	Buss
M	Data 2	Buss
N	Data 4	Buss
P	Data 8	Buss
R	GND	Buss
S	Col Sel. 6	Buss
T	Col Sel. 5	Buss
U	Col Sel. 4	Buss
V	Col Sel. 3	Buss
W	Col Sel. 2	Buss
X	Col Sel. 1	Buss
Y	Field Reset	Buss
Z	GO	A1-22

B2 FIELD DECODER/SEQUENCER
625-053

PIN	SIGNAL	CONNECTION
$\overline{A}$		
$\overline{B}$	TR Field Co	B5-Z
$\overline{C}$	PB Field Co	B4-Z
$\overline{D}$		
$\overline{E}$	PA Field Co	B3-Z
$\overline{F}$		

PIN	SIGNAL	CONNECTION
1	Feedthrough	
2	Feedthrough	
3	Feedthrough	
4	Feedthrough	
5	Feedthrough	
6	Feedthrough	
7	Feedthrough	
8	Feedthrough	
9	ASCII Clock	J104-6
10	Feedthrough	
11	Feedthrough	
12	Feedthrough	
13	Feedthrough	
14	Feedthrough	
15	Feedthrough	
16	Feedthrough	
17	Feedthrough	
18	Feedthrough	
19	Feedthrough	
20	Feedthrough	
21	Feedthrough	
22	Feedthrough	

B2 FIELD DECODER/SEQUENCER
625-053

PIN	SIGNAL	CONNECTION
23		
24	Feedthrough	
25	Feedthrough	
26		
27	Feedthrough	
28		

TITLE

Field Decoder/Sequencer

502, 503, 602 (-2) (-3) (-1)

625-153 --2

A

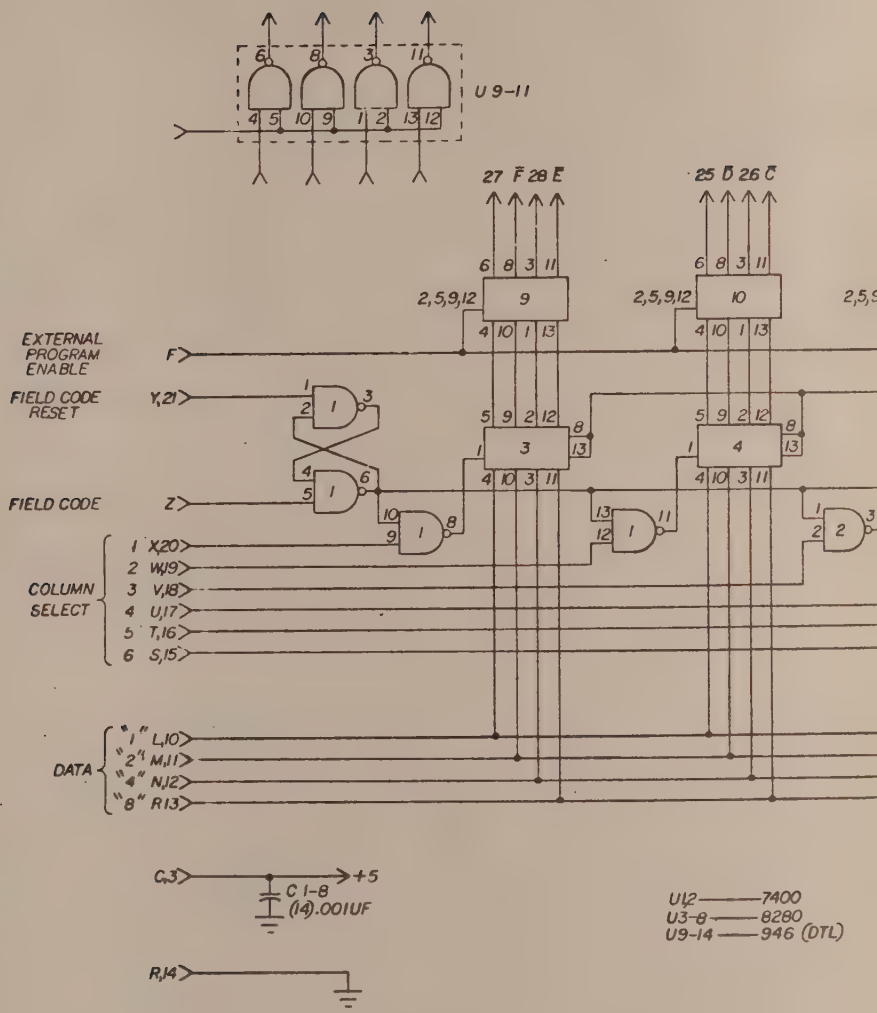
DATE 6-21-77

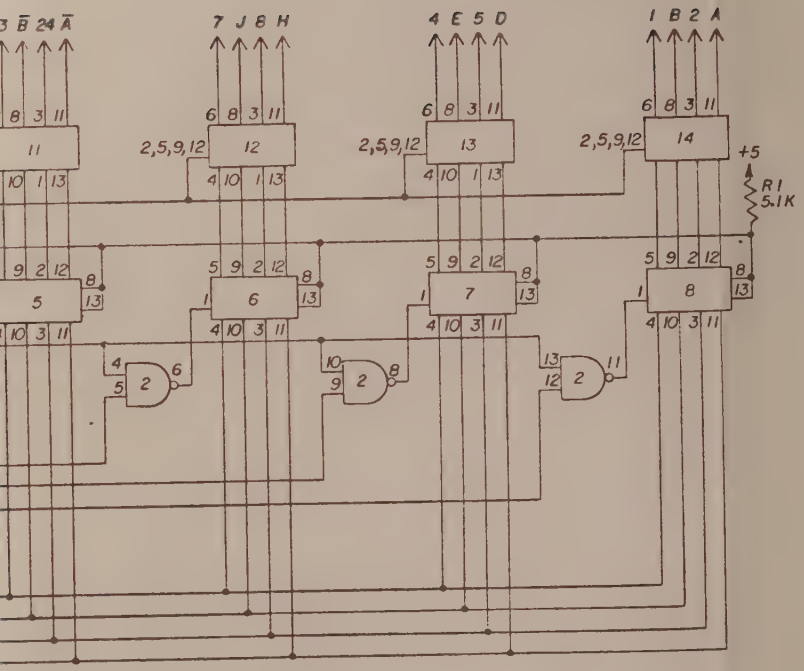
ITEM	ASSEMBLY OR PART NO	DESCRIPTION		SCHEMATIC	QTY
1	101-102	1 k	1/8 W 5% Res	R14-18	5
2	102-102	1 k	1/4 W 5% Res	R3	1
3	102-103	10 k	1/4 W 5% Res	R7,9	2
4	102-153	15 k	1/4 W 5% Res	R10	1
5	102-202	2 k	1/4 W 5% Res	R19	1
6	102-222	2.2 k	1/4 W 5% Res	R2	1
7	102-302	3 k	1/4 W 5% Res	R4	1
8	102-303	30 k	1/4 W 5% Res	R6	1
9	102-332	3.3 k	1/4 W 5% Res	R1	1
10	102-512	5.1 k	1/4 W 5% Res	R8,11,12,20	4
11	112-411	10 k X 7, 2% SIP Res		R5,13	2
12	131-100	10 pF	DM5 Cap	C8	1
13	131-101	100 pF	(factory select)	C11	1
14	131-151	150 pF	DM15 Cap	C9,10	2
15	133-104	.1 µF	Ceramic Cap	C1-7	7
16	150-364	2N3646	NPN Transistor	Q1	1
17	150-404	2N4047	NPN Transistor	Q2	1
18	160-444	IN4448	Diode	CR1-CR*	
19	171-107	74107	Dual J-K	U5	1
20	171-123	74123	TTL One-Shot	U3,12	2
21	171-132	74132	Quad Schmidt NAND	U14,15	2
22	171-175	74175	Quad D Latch	U6,8	2
23	171-704	7404	Hex Inverter	U7,11	2
24	171-710	7410	Trip 3-In NAND	U9,10	2
25	171-737	7437	Quad NAND Driver	U13	1
26	171-796	7496	5-Bit S.R.	U4	1

* Diode number varies with the model; 502 (-2) has 45 diodes, 503 (-3) and 602 (-1) have 56 diodes.

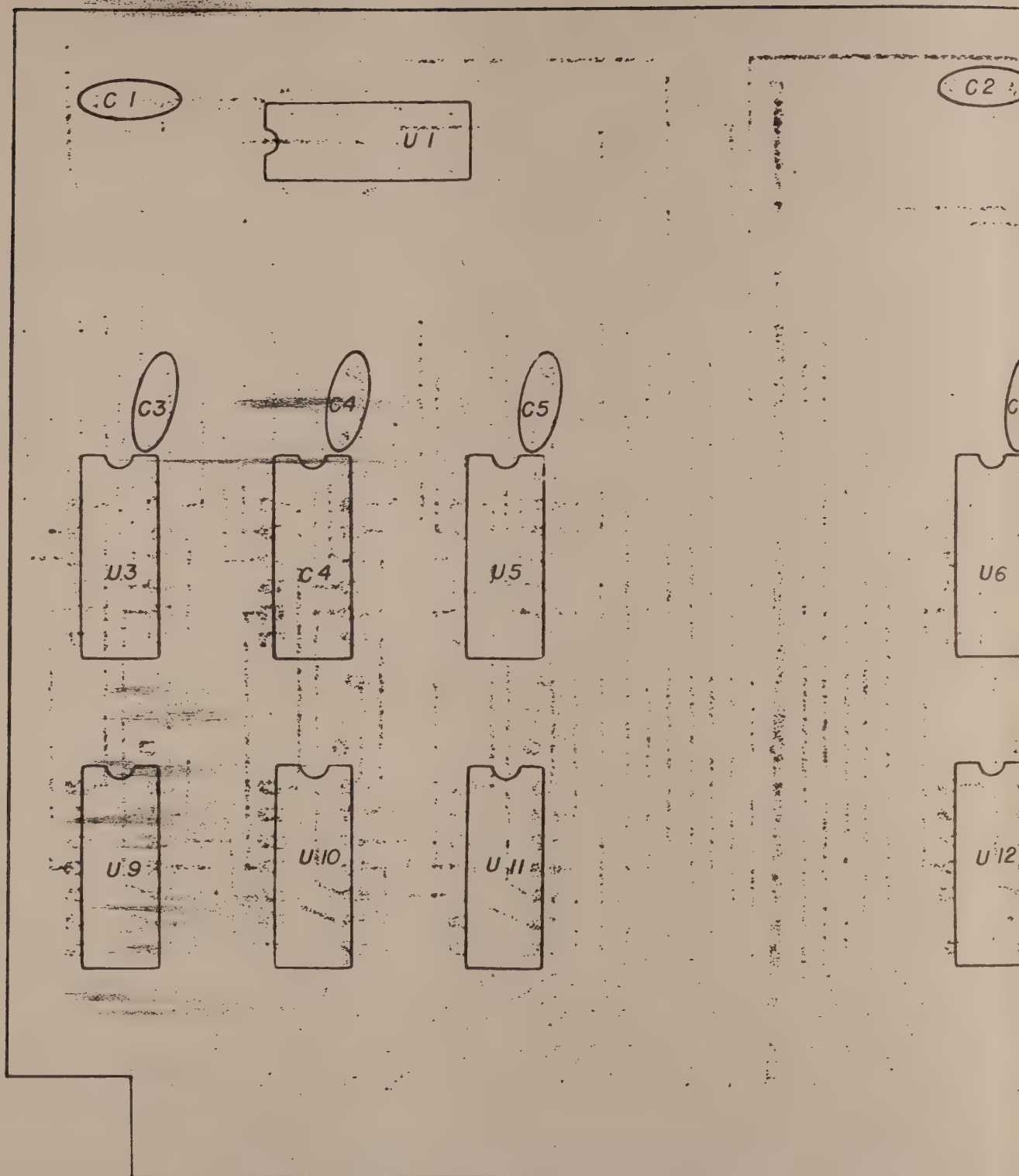
Field Decoder Sequencer	502, 503, 602 (-2) (-3) (-1)	625-153-2	A
6-21-77		2	2

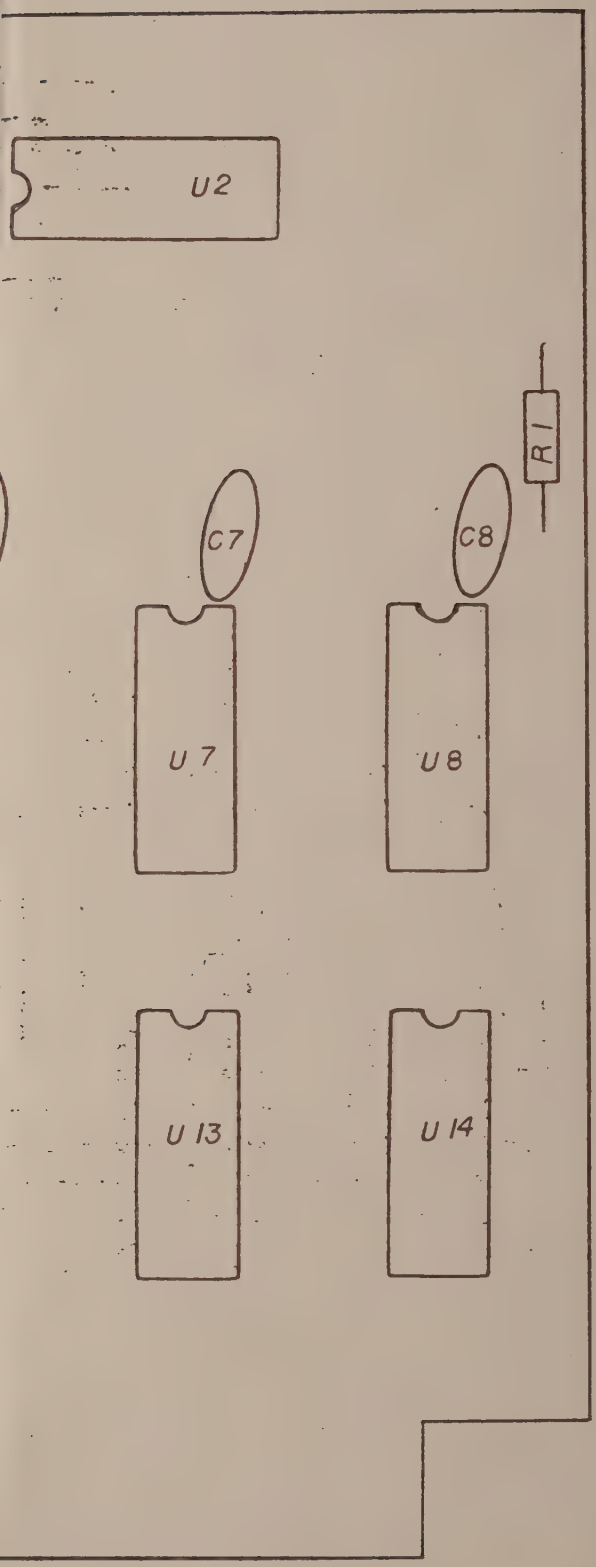
27	178-302	MC3302P Quad Comp	U1,2	2	
28	525-153	P.C. Board	-------	1	


U 9-11
27 F 28 E
25 D 26 C
EXTERNAL PROGRAM ENABLE
F
FIELD CODE RESET
Y,21
FIELD CODE
Z
COLUMN SELECT
1 X,20
2 W,19
3 V,18
4 U,17
5 T,16
6 S,15
DATA
"1" L,10
"2" M,11
"4" N,12
"8" R,13
C,3
+5
C 1-8
(14).001UF
R,14
U1,2 —— 7400
U3-8 —— 8280
U9-14 —— 946 (DTL)



	PROGRAM REGISTER	
CURRENT ECO	625-023	
28	USED:502,503,602	
BD. REV.	9-6-77	RS
A	AUTEK SYSTEMS CORP.	


C1
U1
C2
C3
C4
C5
U3
C4
U5
U6
U9
U10
U11
U12



	PROGRAM REGISTER	
CURRENT ECO	625-023	
28	USED 502,503,602,780 SL01	
BD REV	6-27-77	RS
A	AUTEK SYSTEMS CORP.	

B3, PA PROGRAM REGISTER
625-023

PIN	SIGNAL	CONNECTION
A	PA "8"	S206-1,J106-8
B	PA "2"	S206-2,J106-6
C	+5V	Buss
D	PA "80"	S205-8,J106-20
E	PA "20"	S205-2,J106-18
F	Ext. Program Enable	Buss, S218-7
H	Offset "8"	A3-22,S204-8
J	Offset "2"	A3-24,S204-2
K		
L	Data 1	Buss
M	Data 2	Buss
N	Data 4	Buss
P	Data 8	Buss
R	GND	Buss
S	Col Sel 6	Buss
T	Col Sel 5	Buss
U	Col Sel 4	Buss
V	Col Sel 3	Buss
W	Col Sel 2	Buss
X	Col Sel 1	Buss
Y	Field Reset	Buss
Z	Field Sel	B2-$\overline{E}$

PIN	SIGNAL	CONNECTION
$\overline{A}$		
$\overline{B}$		
$\overline{C}$		
$\overline{D}$	V Range "2"	A3-11, S202-2,J105-14
$\overline{E}$		
$\overline{F}$	V Mult "2"	A3-8,S201-1,J105-15

B3, PA PROGRAM REGISTER
625-023

PIN	SIGNAL	CONNECTION
1	PA "1"	S206-1,J106-5
2	PA "4"	S206-4,J106-7
3	+5V	Buss
4	PA "10"	S205-1,J106-17
5	PA "40"	S205-4,J106-19
6		
7	Offset "1"	A3-23,S204-1
8	Offset "4"	A3-21,S204-4
9		
10		
11		
12		
13		
14	GND	Buss
15		
16		
17		
18		
19		
20		
21		
22		

B3, PA PROGRAM REGISTER
625-023

PIN	SIGNAL	CONNECTION
23		
24	Offset Pol "+"	A3-20,S203-1
25	V Rng "1"	A3-10,S202-1,J105-13
26		
27		
28	V Mult "4"	A3-9,S201-2,J105-16

B4, PB PROGRAM REGISTER
625-023

PIN	SIGNAL	CONNECTION
A	PB "8"	S212-8,J106-16
B	PB "2"	S212-2,J106-14
C	+5V	Buss
D	PB "80"	S211-8,J106-26
E	PB "20"	S211-2,J106-24
F	Ext Program Enable	Buss
H	Offset "8"	A4-22,S210-8
J	Offset "2"	A4-24,S210-2
K		
L	Data 1	Buss
M	Data 2	Buss
N	Data 4	Buss
P	Data 8	Buss
R	GND	Buss
S	Col Sel 6	Buss
T	Col Sel 5	Buss
U	Col Sel 4	Buss
V	Col Sel 3	Buss
W	Col Sel 2	Buss
X	Col Sel 1	Buss
Y	Field Code Reset	Buss
Z	Field Code	Buss

B4, PB PROGRAM REGISTER
625-023

PIN	SIGNAL	CONNECTION
$\overline{A}$	Field Sel	B2-$\overline{C}$
$\overline{B}$		
$\overline{C}$		
$\overline{D}$	V Rng "2"	A4-11,S208-2,J105-18
$\overline{E}$		
$\overline{F}$	V Mult "2"	A4-8,S207-1,J105-19

B4, PB PROGRAM REGISTER
625-023

PIN	SIGNAL	CONNECTION
1	PB "1"	S212-1,J106-13
2	PB "4"	S212-4,J106-15
3	+5V	Buss
4	PB "10"	S211-1,J106-23
5	PB "40"	S211-4,J106-25
6		
7	Offset "1"	A4-23,S210-1
8	Offset "4"	A4-21,S210-4
9		
10		
11		
12		
13		
14	GND	Buss
15		
16		
17		
18		
19		
20		
21		
22		

B4, PB PROGRAM REGISTER
625-023

PIN	SIGNAL	CONNECTION
23		
24	Offset Pol "+"	A4-20,S209-1
25	V Rng "1"	A4-10,S208-1,J105-17
26		
27		
28	V Mult "4"	A4-9,S207-2,J105-20

B5, TR PROGRAM REGISTER
625-023

PIN	SIGNAL	CONNECTION
A		
B		
C	+5V	Buss
D		
E	Del Mode "2"	A5-17,S217-2
F	Ext Program Enable	Buss,S218-7
H	Del Prog "8"	A7-13,S216-8
J	Del Prog "2"	A7-P,S216-2
K		
L	Data 1	Buss
M	Data 2	Buss
N	Data 4	Buss
P	Data 8	Buss
R	GND	Buss
S	Col Sel 6	Buss
T	Col Sel 5	Buss
U	Col Sel 4	Buss
V	Col Sel 3	Buss
W	Col Sel 2	Buss
X	Col Sel 1	Buss
Y	Field Reset	Buss
Z	Field Sel	B2-$\overline{B}$

B5, TR PROGRAM REGISTER
625-023

PIN	SIGNAL	CONNECTION
$\overline{A}$	Del Prog "80"	A7-7,S215-8
$\overline{B}$	Del Prog "20"	A7-H,S215-2
$\overline{C}$	TR"8"	A8-D,A10-M,S218-8,J105-10
$\overline{D}$	TR"2"	A8-5,A10-K,S214-2,J105-8
$\overline{E}$		
$\overline{F}$	T Mult "2"	A6-L,A8-$\overline{A}$,S213-1,J105-11

B5, TR PROGRAM REGISTER
625-023

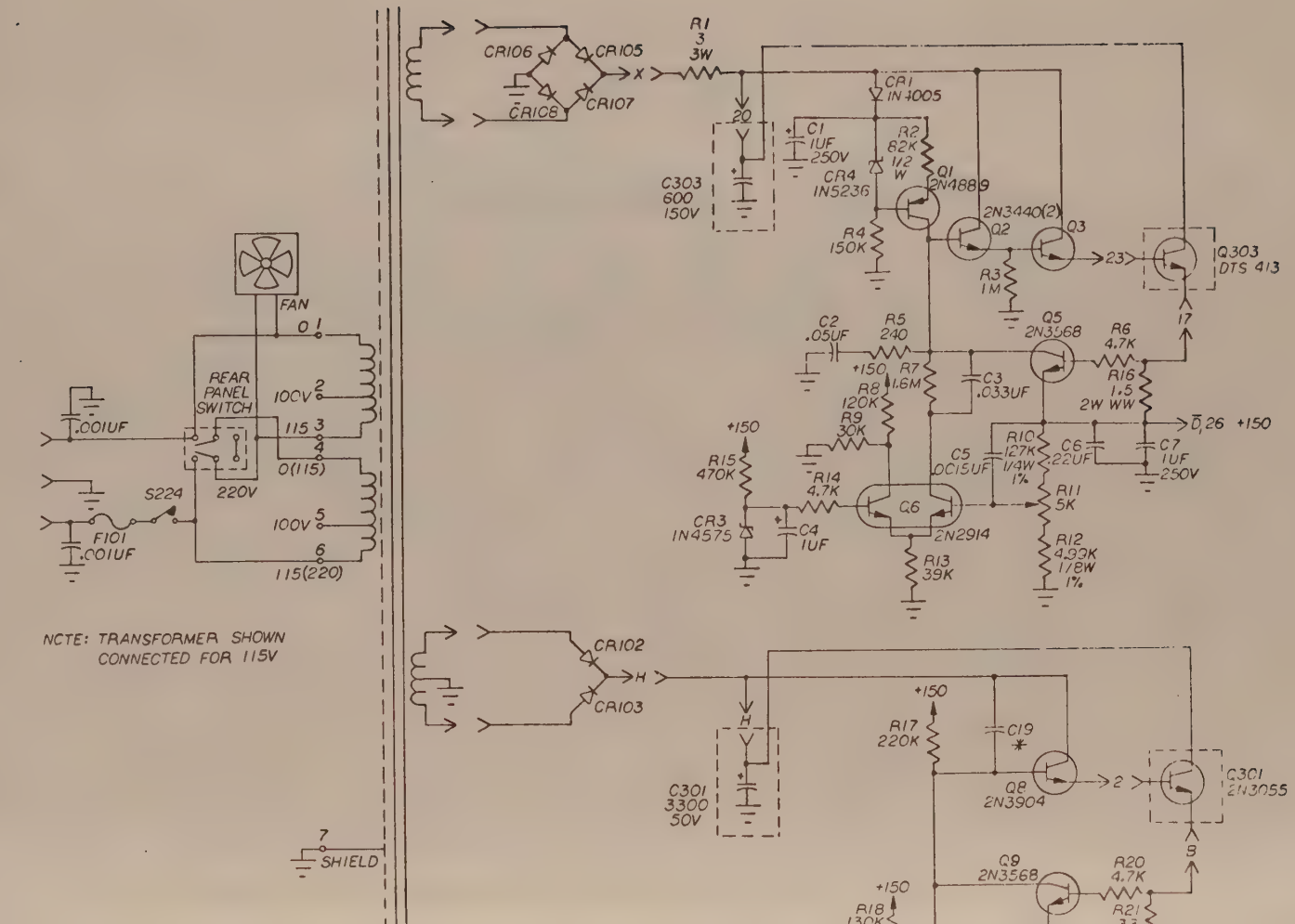
PIN	SIGNAL	CONNECTION
1		
2	Trig Pol "-"	A10-$\overline{A}$,S218-1
3	+5V	Buss
4	Del Mode "2"	A5-F,S217-1
5	Del Mode "4"	A5-18,S217-4
6		
7	Del Prog "1"	A7-T,S216-1.
8	Del Prog "4"	A7-S,S216-4
9		
10		
11		
12		
13		
14	GND	
15		
16		
17		
18		
19		
20		
21		
22		

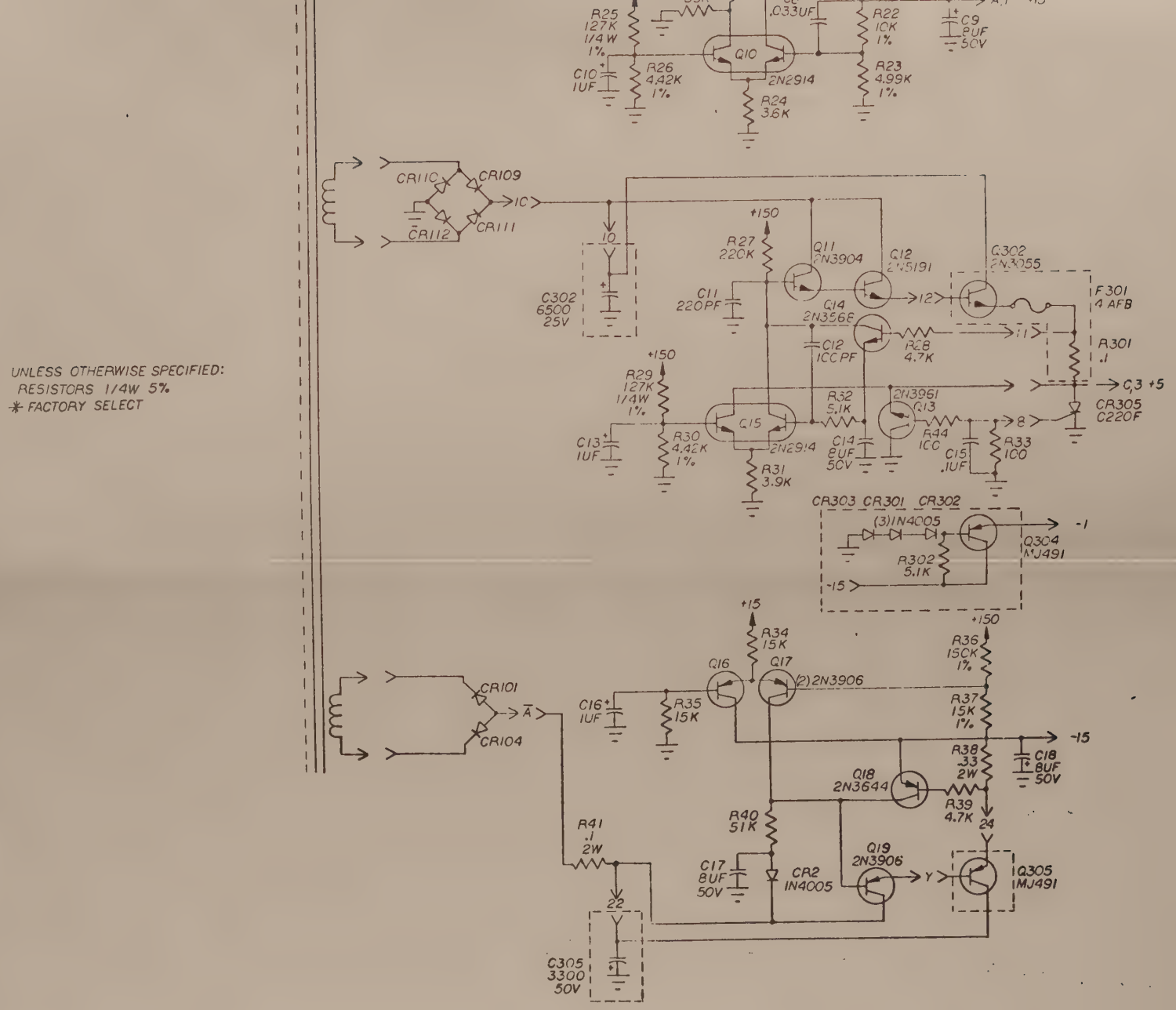
B5, TR PROGRAM REGISTER
625-023

PIN	SIGNAL	CONNECTION
23	Del Prog "10"	A7-9,S215-1
24	Del Prog "40"	A7-J,S215-4
25	TR"1"	A8-E,A10-L,S214-1,J105-7
26	TR"4"	A8-4,A10-N,S214-4,J105-9
27		
28	T Mult "4"	A6-M,A8-$\overline{B}$,S213-2,J105-12

TITLE	USED ON	B/M	
Program Register	502,	625-023	C
DRN RCB DATE 8-20-75 / CHK DATE / PROJ DATE		PAGE 1 OF 1	REV

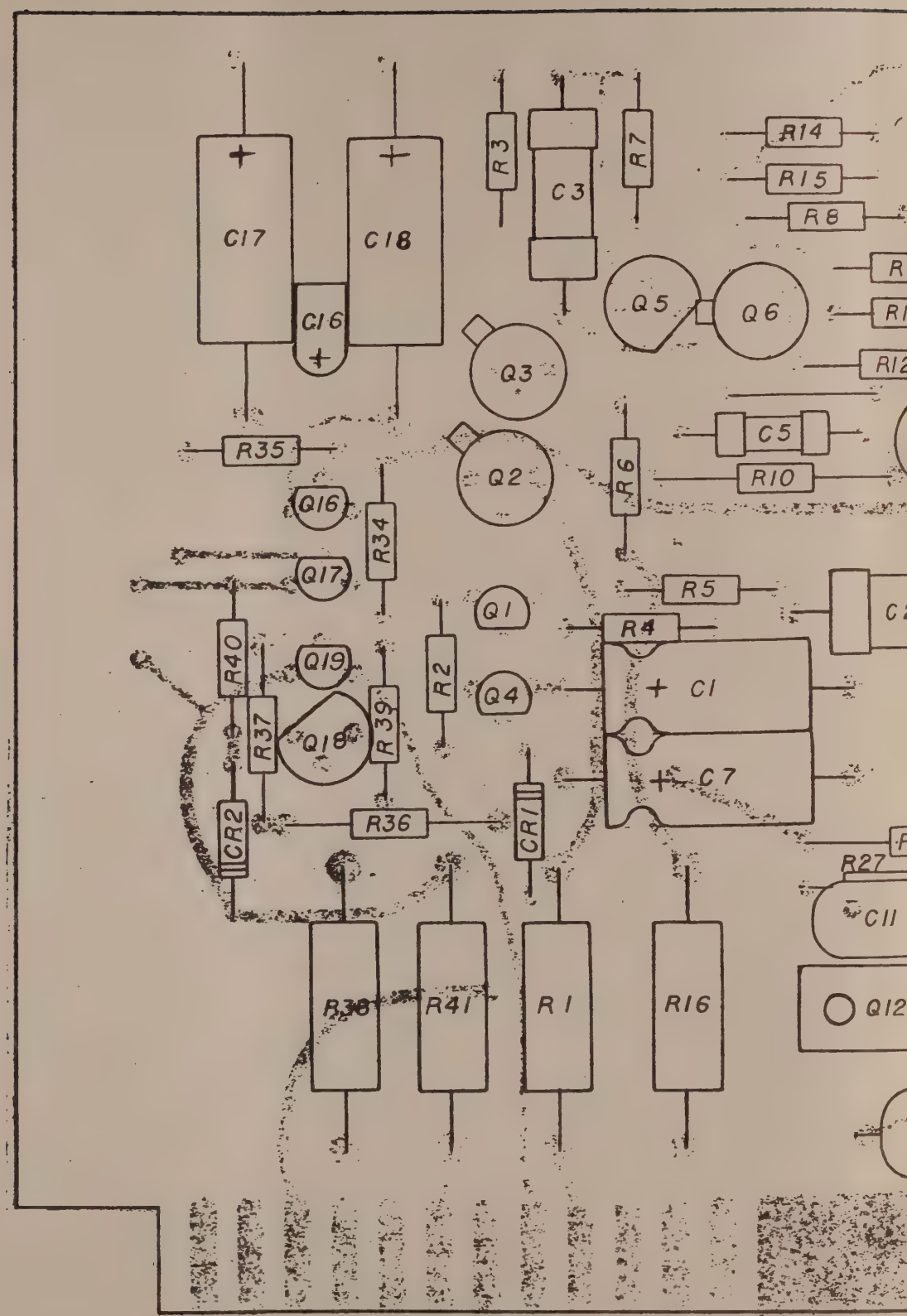
ITEM	ASSEMBLY OR PART NO	DESCRIPTION	SCHEM. REF.	QTY PER ASSY	UNIT COST	EXT.	DWG SIZE	DWG
1	102-512	5.1 K 1/4w 5% Res	R1	1				
2	133-104	.1 µF Capacitor	C1-8	8				
3	170-946	MC 946	U9-14	6				
4	171-700	MC 7400	U1,2	2				
5	171-880	S8280 or equivalent	U3-8	6				
6	525-023-A	P. C. Board	-------	1				
7	000-001	LBR-PCB Stuffing	---------	1				
8	000-002	LBR-PCB Touch-up	---------	1				
9	000-003	LBR-PCB Wave Solder	---------	0.05				

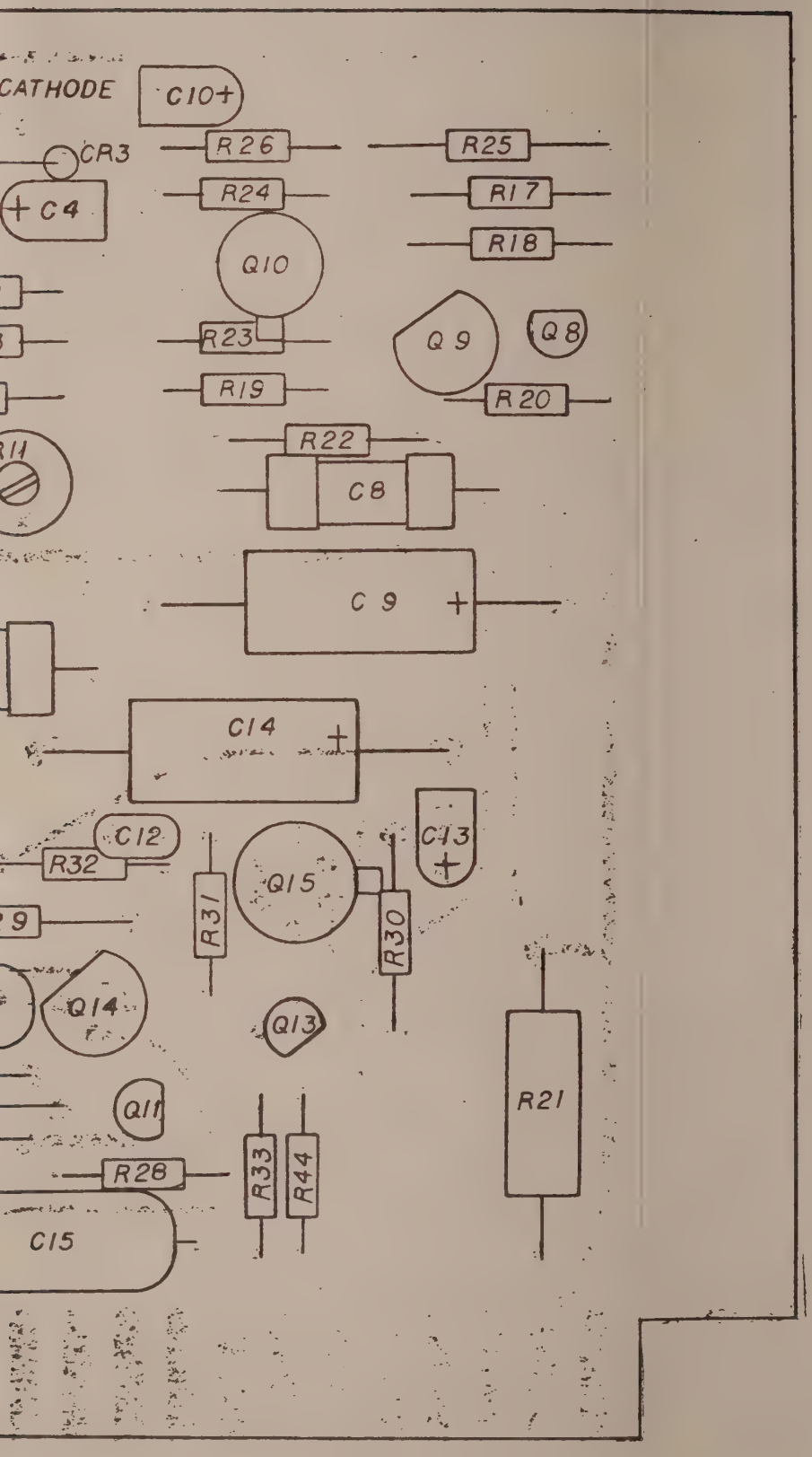

CR106
CR105
CR108
CR107
X
R1
3
3W
20
C303
600
150V
C1
1UF
250V
CR1
IN4005
R2
82K
1/2
W
CR4
IN5236
Q1
2N4889
2N3440(2)
Q2
Q3
R4
150K
R3
1M
23
Q303
DTS 413
17
C2
.05UF
R5
240
R7
1.6M
Q5
2N3568
R6
4.7K
R16
1.5
2W WW
+150
R8
120K
R9
30K
C3
.033UF
0,26 +150
R10
127K
1/4W
1%
C6
.22UF
C7
1UF
250V
C5
.0015UF
R11
5K
R15
470K
R14
4.7K
CR3
IN4575
C4
1UF
Q6
2N2914
R12
4.99K
1/8W
1%
R13
39K
FAN
0 1
REAR
PANEL
SWITCH
100V 2
115 3
4
0(115)
.001UF
S224
220V
F101
.001UF
100V 5
6
115(220)
NOTE: TRANSFORMER SHOWN
CONNECTED FOR 115V
CR102
CR103
H
C301
3300
50V
+150
R17
220K
C19
*
Q8
2N3904
2
C301
2N3055
9
Q9
2N3568
R20
4.7K
R21
+150
R18
7
SHIELD



UNLESS OTHERWISE SPECIFIED:
RESISTORS 1/4W 5%
* FACTORY SELECT

CURRENT ECO		POWER SUPPLY
	USED:	625-013-2
BD REV		502
11-15-77	TV	
AUTEK SYSTEMS CORP		


C17
C18
C16
R3
C3
R7
R14
R15
R8
Q5
Q6
Q3
Q2
R35
R6
C5
R10
Q16
R34
Q17
R5
Q1
R4
C1
R40
Q19
R2
Q4
C7
R37
Q18
R39
CR2
R36
CR1
R27
C11
R38
R41
R1
R16
Q12



POWER SUPPLY
625-013-2

B6, POWER SUPPLY
625-013

PIN	SIGNAL	CONNECTION
A	15V	
B	Pass element +15V	
C	+5V	Buss,R301-1
D		
E		
F		
H	Unreg. +15V	C301+,Q301C,D1-7
J		
K		
L	Unreg +5 V	C302+,Q302-C
M	Pass element +5V	F301-1,R301
N	Pass element +5V	Q302-B
P	GND	
R	GND	Buss
S	GND	
T		
U	Pass element +150V	Q303-E
V		
W		
X	Unreg +150V	D1-11
Y	Pass element -15V	Q305-B
Z		

B6, POWER SUPPLY
625-013

PIN	SIGNAL	CONNECTION
$\overline{A}$	Unreg -15V	D1-8
$\overline{B}$		
$\overline{C}$		
$\overline{D}$	+150V	
$\overline{E}$		
$\overline{F}$	-15V	

B6, POWER SUPPLY
625-013

PIN	SIGNAL	CONNECTION
1	15V	
2	Pass element +15V	0301-1
3	+5V	Buss,R301-1
4		
5		
6		
7		
8	SCR Control	D305
9		
10	Unreg +5V	C302+,D1-9,Q302-C
11	Pass element +5V	F301-1,R301
12	Pass element +5V	Q302-B
13	GND	
14	GND	Buss
15	GND	
16	GND	
17	Pass element +150V	Q303-E
18		
19		
20	Pass element +150V	C303+,Q303-C
21		
22	Pass element -15V	C305-,Q305-C

B6, POWER SUPPLY
625-013

PIN	SIGNAL	CONNECTION
23	Pass element +150V	Q303-B
24	Pass element -15V	Q305-E
25		
26	+150V	
27		
28	-15V	

TITLE			USED ON	B/M 625-013 -2							G
Power Supply			502								
PREP DATE	CHK DATE		REL DATE	PAGE 1 OF 2							REV.
BB 7-22-75	[illegible] 7-23-75										

ITEM	ASSEMBLY OR PART NO	DESCRIPTION				SCHEM. REF.	QTY ASSY	ISS'D	UNIT COST	UNIT	EXTENSION	SHORT
1	102-101	100 ohm	1/4w	5%	Res	R33,42	2					
2	102-105	1 meg	1/4w	5%	Res	R3	1					
3	102-124	120 k	1/4w	5%	Res	R8	1					
4	102-134	130 k	1/4w	5%	Res	R18	1					
5	102-153	15 k	1/4w	5%	Res	R34,35	2					
6	103-154	150 k	1/2w	5%	Res	R4	1					
7	102-165	1.6 meg	1/4w	5%	Res	R7	1					
8	102-224	220 k	1/4w	5%	Res	R17,27	2					
9	102-240	240 ohm	1/4w	5%	Res	R5	1					
10	102-303	30 k	1/4w	5%	Res	R9	1					
11	102-392	3.9 k	1/4w	5%	Res	R31	1					
12	102-393	39 K	1/4w	5%	Res	R13,19	2					
13	102-472	4.7 k	1/4w	5%	Res	R6,14,20, 24,28,39	6					
14	108-483	71.5k	1/2w	5%	Res	R15	1					
15	102-512	5.1 k	1/4w	5%	Res	R32	1					
16	102-513	51 k	1/4w	5%	Res	R40	1					
17	102-823	82 k	1/4w	5%	Res	R2	1					
18	107-368	4.99 k	1/8w	1%	Res	R12,23	2					
19	107-363	4.42 k	1/8w	1%	Res	R26,30	2					
20	107-401	10 k	1/8w	1%	Res	R22	1					
21	107-418	15 k	1/8w	1%	Res	R37	1					
22	107-511	127 k	1/8w	1%	Res	R10,25,29	3					
23	107-518	150 k	1/8w	1%	Res	R36	1					
24	114-001	.1 ohm	2w	5%	Res	R41	1					
25	114-003	.33 ohm	2w	5%	Res	R21,38	2					
26	114-015	1.5 ohm	2w	5%	Res	R16	1					

REVISIONS:

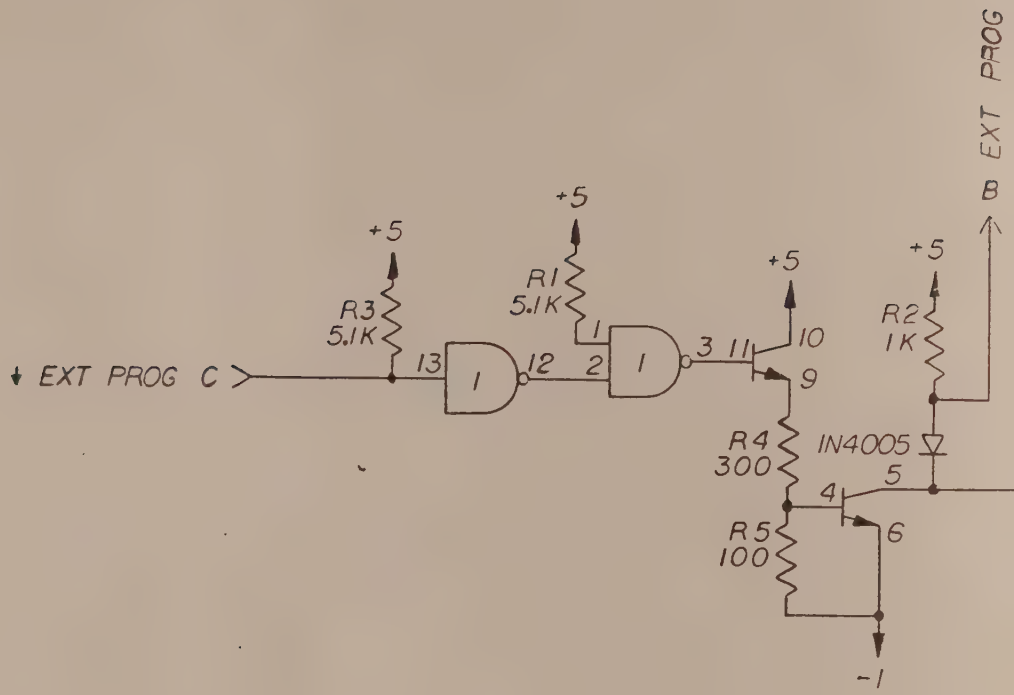
B/M

TITLE		USED ON	B/M 625-013 -2							G
Power Supply		502								
PREP DATE	CHK DATE	REL DATE	PAGE 2 OF 2							REV
7-22-75	7-23-75									

ITEM	ASSEMBLY OR PART NO	DESCRIPTION	SCHEM. REF.	QTY ASSY	ISS'D	UNIT COST	UNIT	EXTENSION	SHORT
27	114-030	3 ohm 3w 5% Res	R1	1					
28	125-502	5 k Pot (A/B SV5021)	R11	1					
29	131-101	100 pF DM-5 Cap	C12	1					
30	131-221	220 pF DM-5 Cap	C11	1					
31	135-152	.0015 uF @200V Cap	C5	1					
32	135-333	.033 uF @200V Cap	C3,8	2					
33	135-104	.10 uF 10% 200V Cap	C12	1					
34	135-473	.047 uF @200V Cap	C2	1					
35	137-105	1 uF @35V Cap	C4,10,13, 16	4					
36	138-010	1 uF @250V Cap	C1,7	2					
37	138-080	8 uF @50V Cap	C9,14,17, 18	4					
38	150-291	2N2914 Transistor	Q6,10,15	3					
39	150-344	2N3440 Transistor	Q2,3	2					
40	150-357	2N3568 Transistor	Q5,9,14	3					
41	150-369	2N3691 Transistor	Q13	1					
42	150-390	2N3904 Transistor	Q8,11	2					
43	151-390	2N3906 Transistor	Q4, ,16, 17,19	4					
44	151-364	2N3644 Transistor	Q18	1					
45	151-540	2N5401 Transistor	Q1	1					
46	157-519	2N5191 Transistor	Q12	1					
47	160-400	1N4005 Diode	D1,2	2					
48	525-013	P.C. Board	------	1					
49	164-475	1N 4575 Diode	@Q7	1					
50	131-301	300 PF 5% 300V Cap	C12	1					
51	131-101	100pF DM-5 Factory select	C19	1					
52	255-105	Turret Term 2024C	T1-5	5					
53	164-536	1N5236B, DO-7 7.5V 5% .5W	CR4	1					

B/M

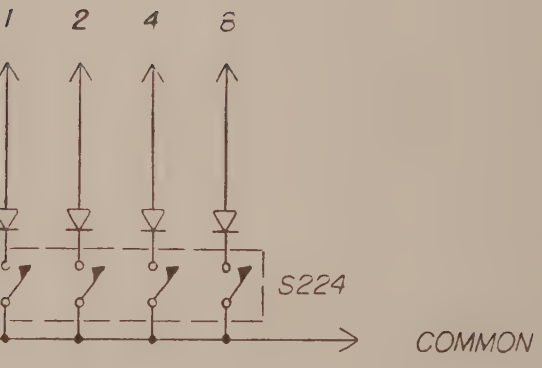
REVISIONS:


+5
+5
+5
+5
R3
5.1K
R1
5.1K
R2
1K
R4
300
R5
100
IN4005
EXT PROG C
B EXT PROG
13
12
1
2
3
11
10
9
4
5
6
-1

A > +5

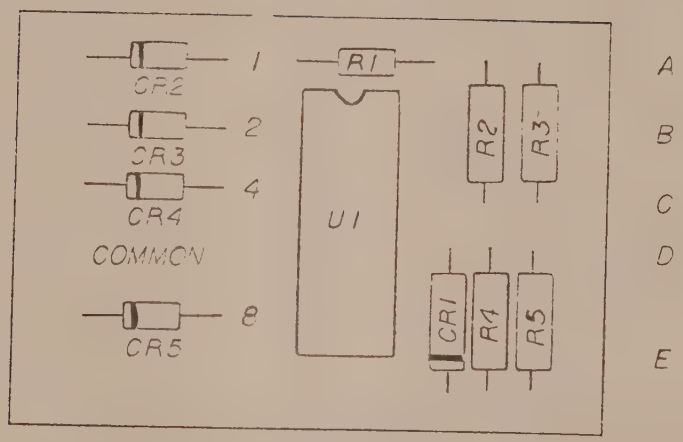
D > -1

E >



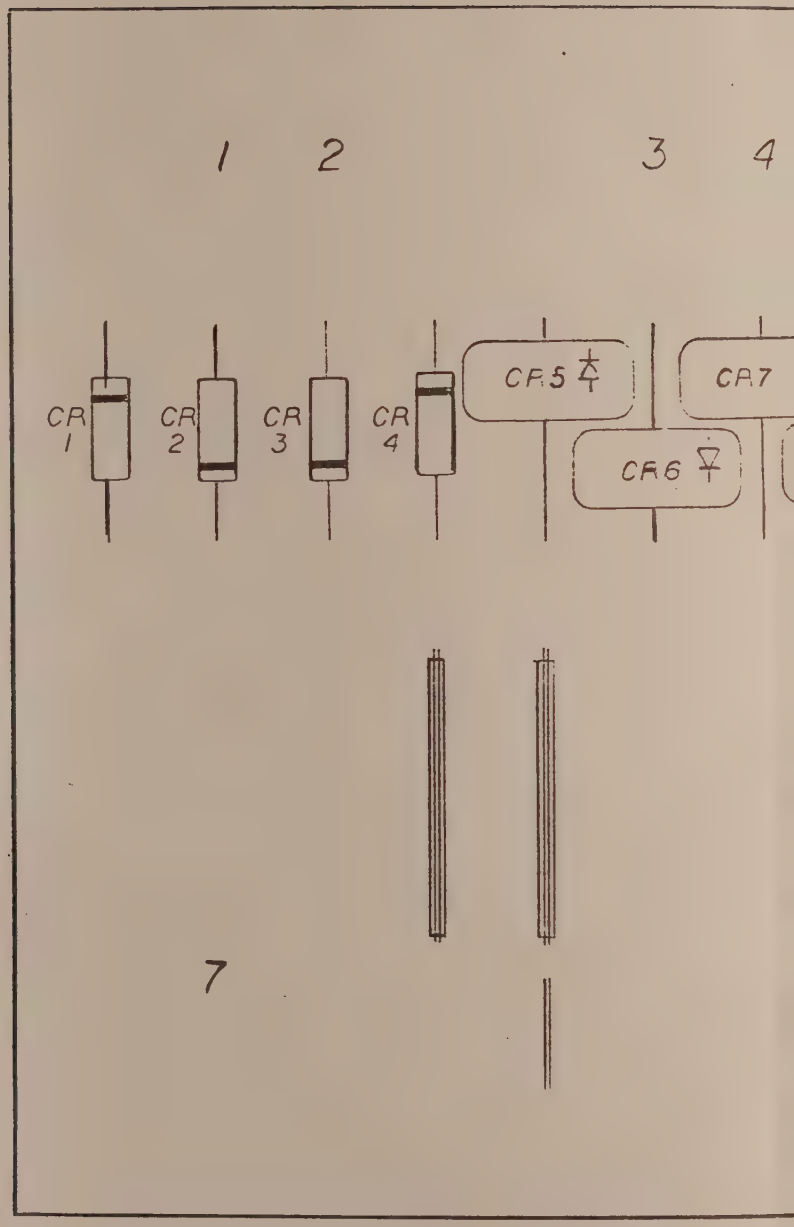
U1——75450
UNLESS OTHERWISE NOTED:
RESISTORS 1/4W 5%.
DIODES IN4448

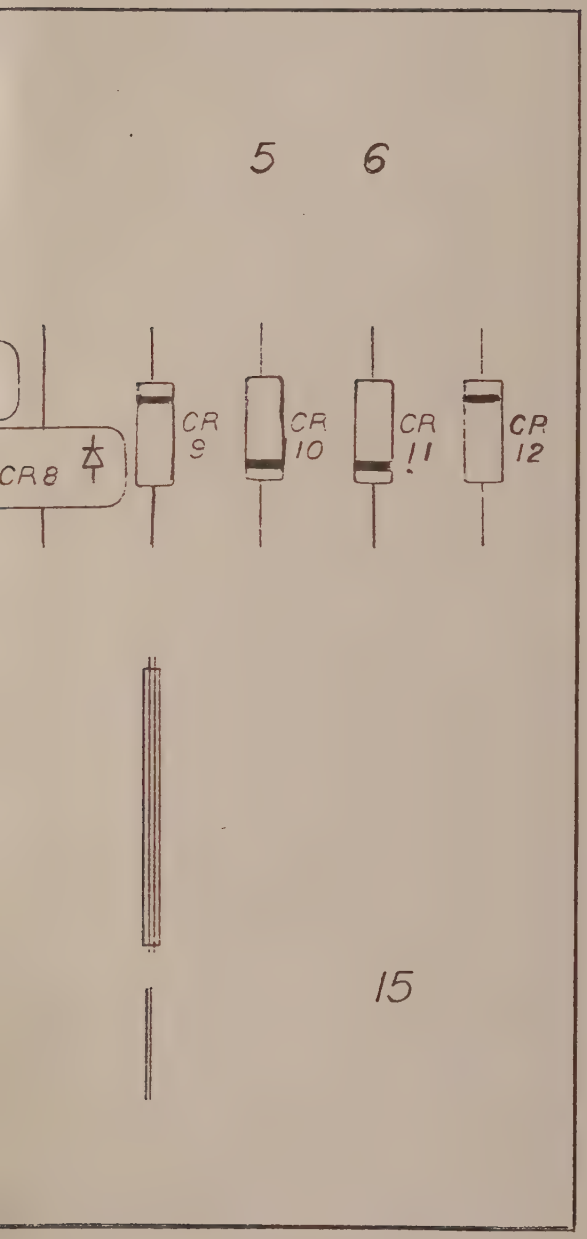
	BUSS CONTROL	
CURRENT ECO	625-027	
	USED ON: 502,503,602 780 SDL01	
BD REV	8-12-77	TV
A	AUTEK SYSTEMS CORP	



CHECK B/M FOR WHICH DIODES TO INSTALL

BUS CONTROL
625-027


1
2
3
4
CR 1
CR 2
CR 3
CR 4
CR5
CR7
CR6
7



	RECTIFIER BOARD
	625-037-2
	USED: 502
REV	
A	AUTEK SYSTEMS CORP

D1, RECTIFIER BOARD
625-037

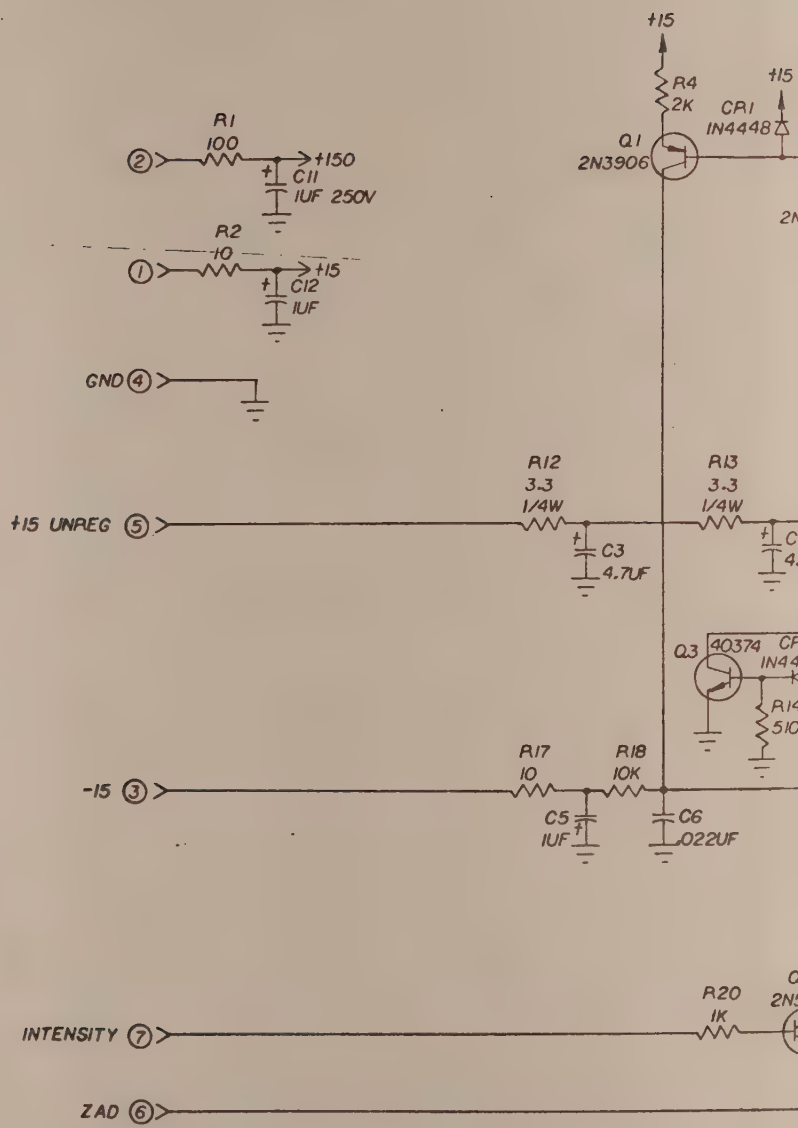
PIN	SIGNAL	CONNECTION
1	Raw 15V	T101-9
2	Raw 15V	T101-11
3	Raw 5V	T101-12
4	Raw 5V	T101-13
5	Raw 150V	T101-8
6	Raw 150V	T101-7
7	Unreg +15V	C301,Q301-C,B6-H
8	Unreg -15V	B6-$\overline{A}$
9	Unreg +5V	C302+,Q302-C,B6-10
10	GND	D1-17
11	Unreg 150V	B6-X
12	GND	D1-19
13	GND	Power Supply Chassis
14	GND	T101-10
15		
16	Shield	T101-SH
17	GND	D1-10
18		
19	GND	D1-12
20		
21		
22		

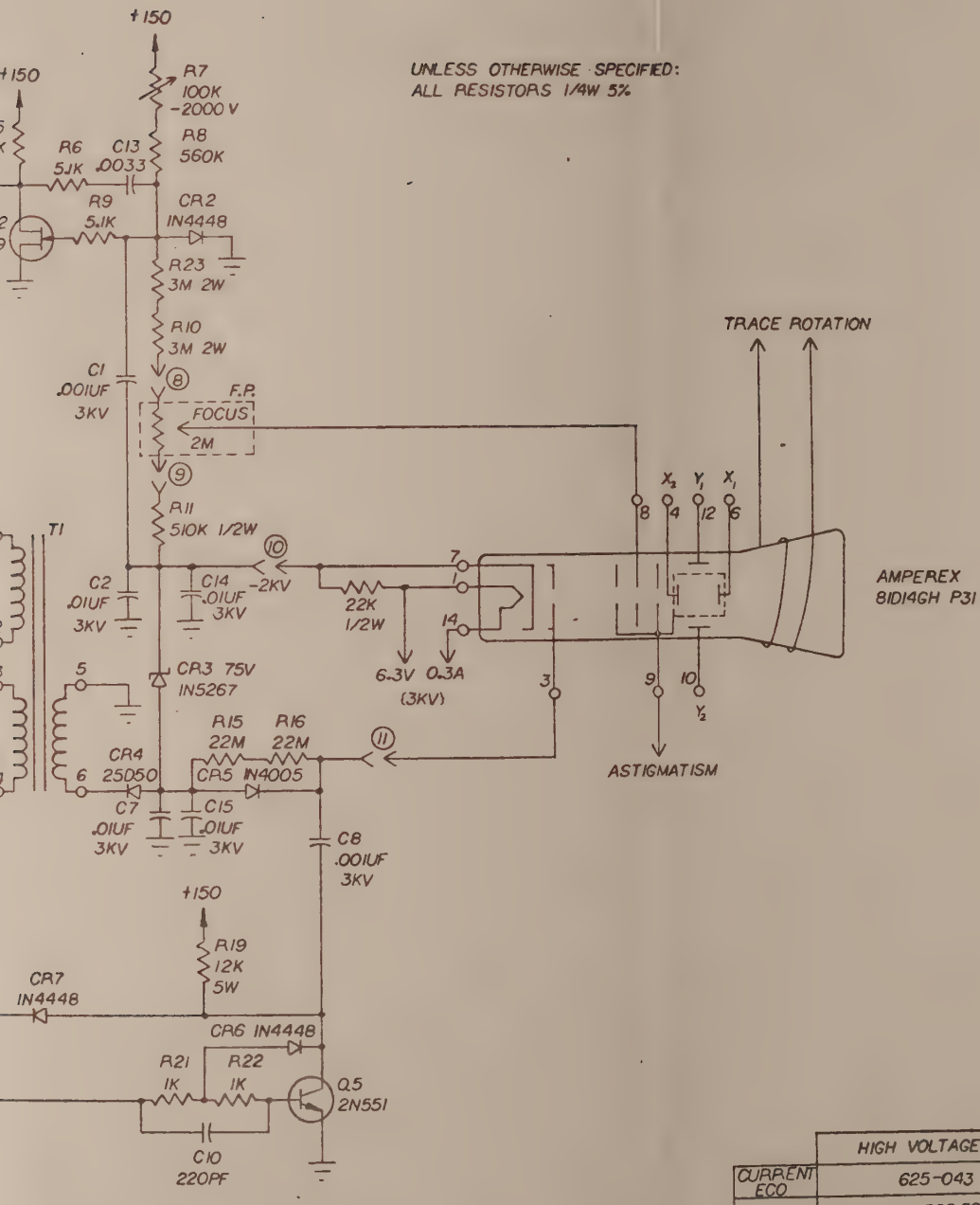
TITLE	USED ON	B/M 625-037-2	C
Rectifier Board	502		
PREP DATE 7/19/76 / CHK DATE / REL DATE		PAGE 1 OF 1	REV.

ITEM	ASSEMBLY OR PART NO	DESCRIPTION	SCHEM. REF.	QTY / ASSY	ISS'D	UNIT COST	UNIT	EXTEN-SION	SHORT
1	160-400	1N4005 Diode	CR1-4,9-12	8					
2	160-751	MR751, MP Diode	CR5-8	4					
3	525-037	P.C. Board	--------	1					

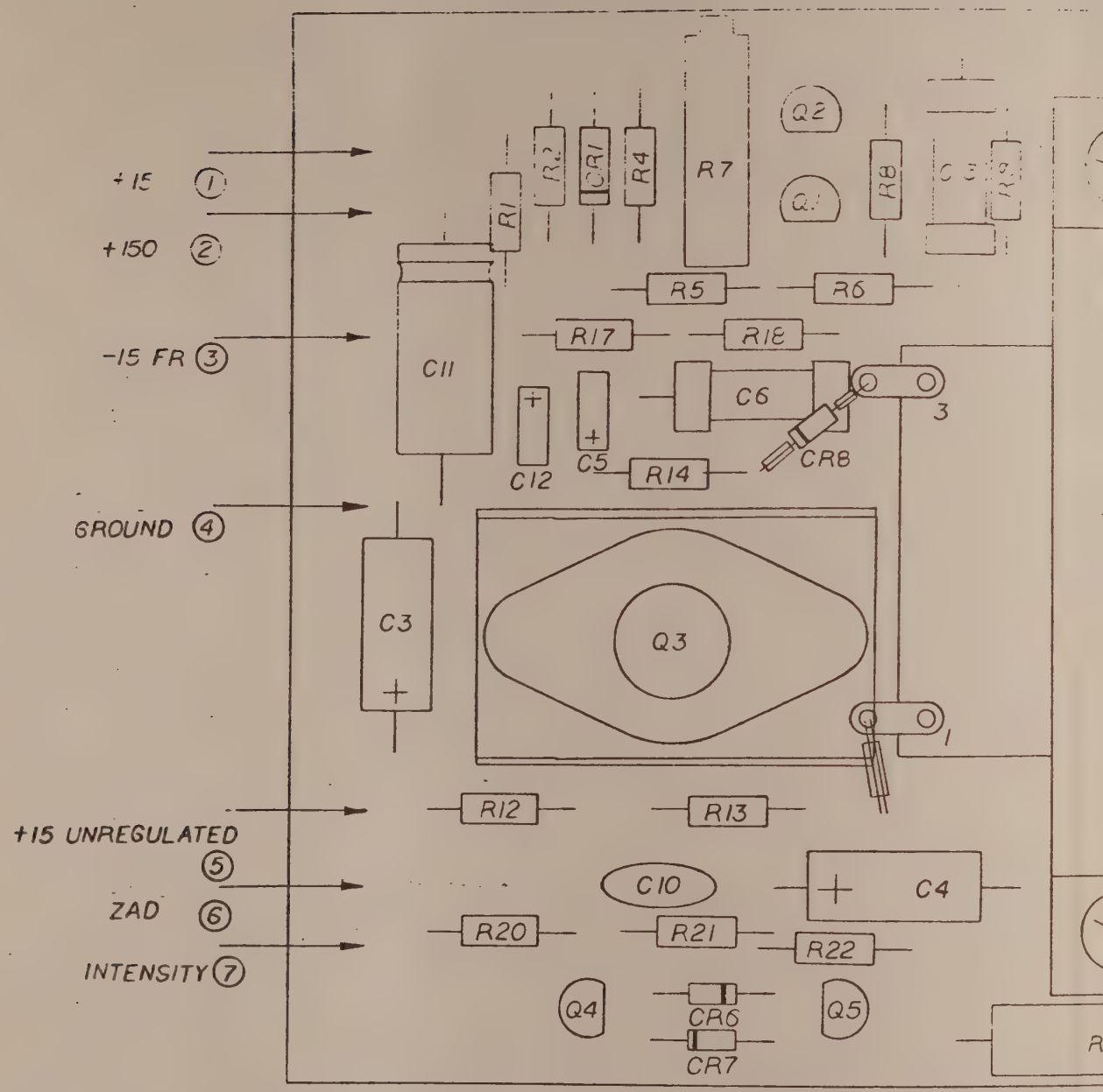
B/M

REVISIONS

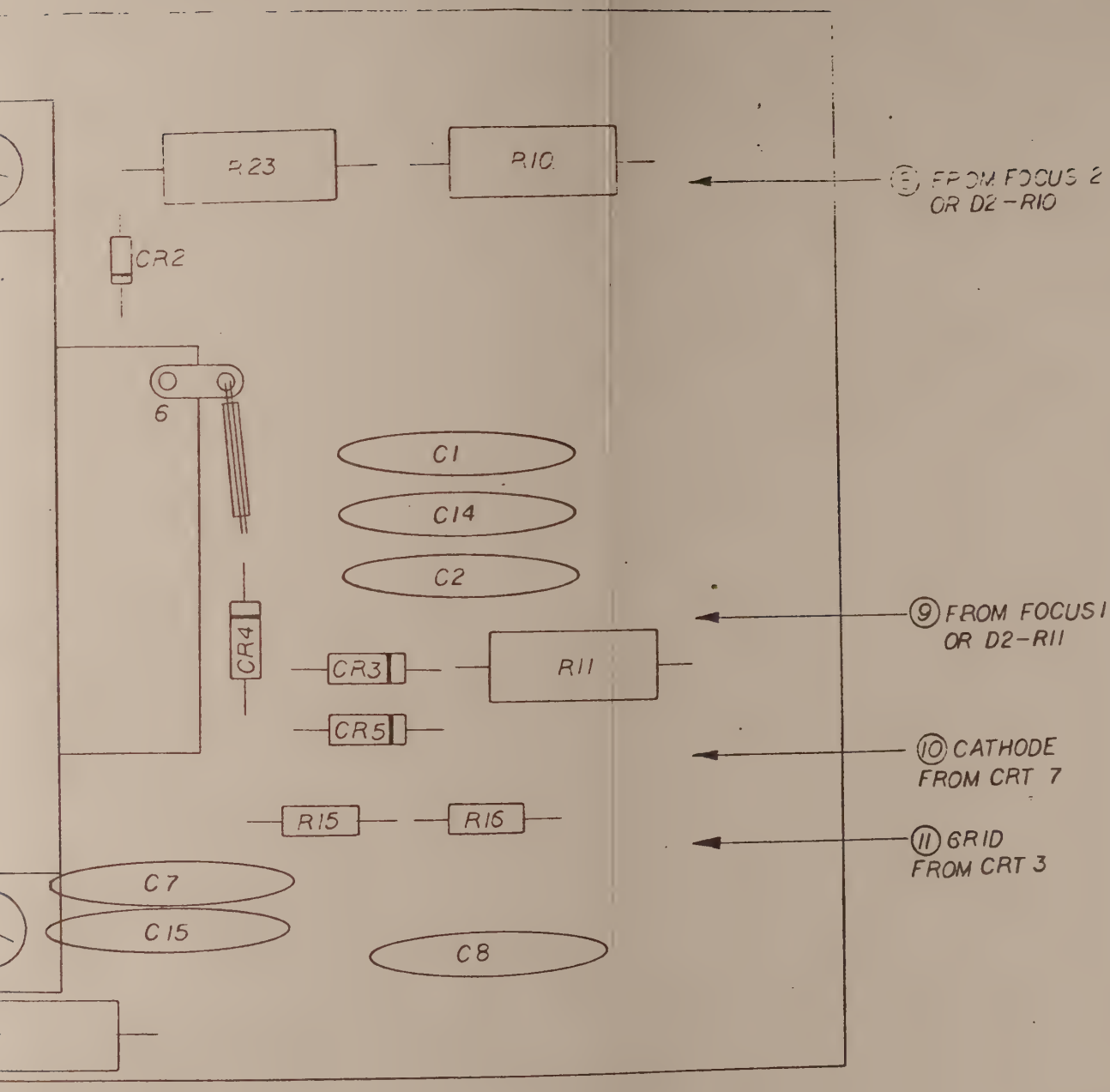

+15
R4
2K
CR1
IN4448
Q1
2N3906
R1
100
+150
C11
1UF 250V
R2
10
+15
C12
1UF
GND 4
R12
3.3
1/4W
R13
3.3
1/4W
+15 UNREG 5
C3
4.7UF
Q3
40374
R17
10
R18
10K
-15 3
C5
1UF
C6
.022UF
R20
1K
INTENSITY 7
ZAD 6



	HIGH VOLTAGE SUPPLY	
CURRENT ECO	625-043	
	USED: 505,502,504,621	
BD REV	9-13-77	DL
C	AUTEK SYSTEMS CORP	



	M502				M504/M505		
#	FROM	COL	WIRE	#	FROM	COL	WIRE
1				1	A18-Y,43	4N	22GA
2				2	A18-E,5	5N	22GA
3				3	A18-A,1	1N	22GA
4				4	A18-Z,22	0N	22GA
5				5	FUSE	6N	22GA
6				6	A5-13	3N	22GA
7				7	INTENSITY	2N	22GA
8				8	FOCUS 2		3000V
9				9	FOCUS 1		"
10				10	TO CRT-7		"
11				11	TO CRT-3		"



PUT BCARD ON SIDE PANEL SO THAT POT IS ADJUSTABLE FROM TOP OF MACHINE

	HIGH VOLTAGE	
CURRENT ECO	625-043	
	USED ON: 505	
BD REV	7-20-77	DL
D	AUTEK SYSTEMS CORP	

D2, HIGH VOLTAGE POWER SUPPLY
625-043

PIN	SIGNAL	CONNECTION
1	+15V	B1-1
2	+150V	B1-26
3	-15V	B1-28
4	GND	B1-14
5	+15V unreg	C301+
6	ZAD	A1-T
7	Intensity	R202-2
8	Focus	R201-1
9	Focus	R201-3
10	-1700 Cathode	CRT-7
11	-1800 Grid.	CRT-3
12		
13		
14		
15		
16		
17		
18		
19		
20		
21		
22		

TITLE	DWG NO		REV
H.V. Power Supply	502	B/M 625-043	H
DRN REB 6-26-75	CHK [illegible] 6/30/75	PAGE 1 OF 2	DEV

ITEM	ASSEMBLY OR PART NO	DESCRIPTION	SCHEMATIC REF	REQ PER	UNIT COST	EXTENSION	SHT
1	102-010	10 ohm 1/4w 5% Res	R2,17	2			
2	102-101	100 ohm 1/4w 5% Res	R1	1			
3	102-102	1 k 1/4w 5% Res	R20-22	3			
4	102-103	10 k 1/4w 5% Res	R18	1			
5	102-202	2 k 1/4w 5% Res	R4	1			
6	102-226	22 Meg 1/4w 5% Res	R15,16	2			
7	102-3R3	3.3 ohm 1/4w 5% Res	R12,13	2			
8	102-511	510 ohm 1/4w 5% Res	R14	1			
9	102-512	5.1 k 1/4w 5% Res	R6,9	2			
10	102-564	560 k 1/4w 5% Res	R8	1			
11	102-683	68 k 1/4w 5% Res	R5	1			
12	103-514	510 k 1/2w 5% Res	R11	1			
13	105-305	3 Meg 2w 5% Res	R10,23	2			
14	114-123	12 k 5w Res	R19	1			
15	125-015	100 k Pot	R7	1			
16	131-221	220 pF Cap	C10	1			
17	135-223	.022 uF Cap	C6	1			
18	135-332	.0033 uF Cap	C13	1			
19	136-106	.001 uF @ 3kV Cap	C1,8	2			
20	136-107	.01 uF @ 3kV Cap	C2,7,14,15	4			
21	137-105	1 uF @ 50V Cap	C5,12	2			
22	137-503	4.7 uF @ 35V Cap	C3,4	2			
23	138-010	1 uF @ 250V Cap	C11	1			
24	150-555	2N5551	Q5	1			
25	151-390	2N3906	Q1	1			
26	151-540	2N5401	Q4	1			

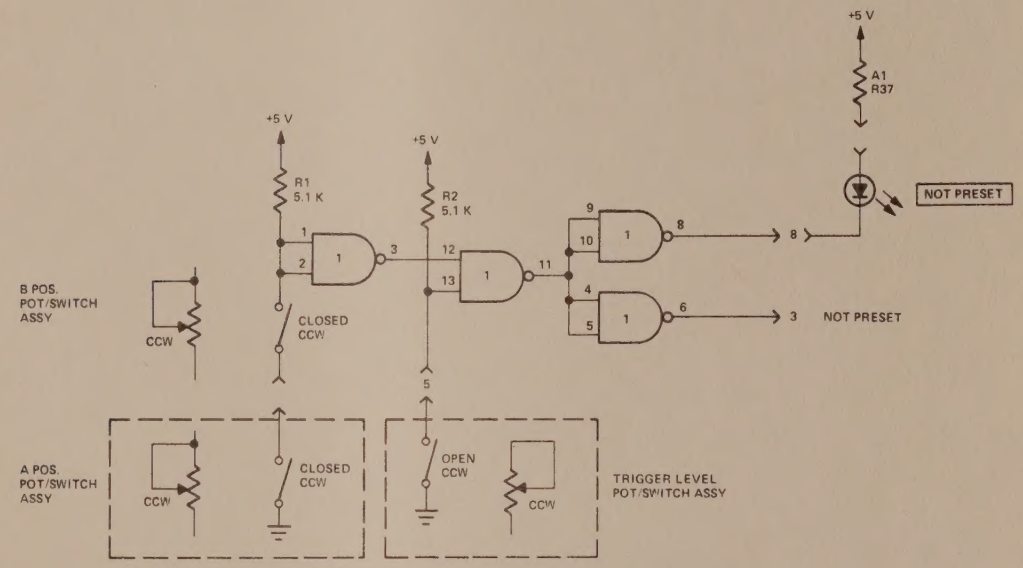
REVISIONS

TITLE	DOCUMENT	B/M	REV
H.V. Power Supply	502	625-043	H
REB 6-26-75	C DATE ASR 6/30/75	PAGE 2 OF 2	REV

ITEM	ASSEMBLY OR P/N	DESCRIPTION	SCHEM REF	QTY/ASSY			
27	153-381	2N3819	Q2	1			
28	157-403	RCA 40374	Q3	1			
29	160-400	IN4005	D5	1			
30	160-444	1N4448	D1,2,6-8	5			
31	164-567	1N5267 75V Zener	CR3	1			
32	168-205	25D50 HV Diode	D4	1			
33	228-003	Transformer	T1	1			
34	239-010	Clamp, HV Txfmr	-----	1			
35	525-043	P.C. Board	-----	1			
36	000-001	LBR-PCB Stuffing	----	0.5			
37	000-002	LBR-PCB Touch-up	----	0.5			
38	000-009	LBR- Final Test	----	0.5			

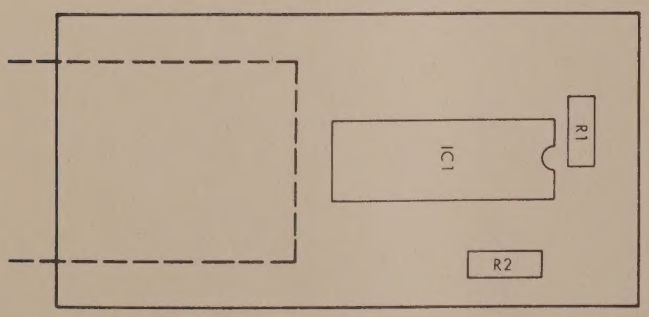
MODEL 502
CIRCUIT DESCRIPTION
NOT PRESET LOGIC
SCHEMATIC 625-081

The Not Preset Logic circuits are mounted on the B-Position potentiometer/switch assembly. The circuit consists of one integrated circuit and two resistors. The NAND-gates in the integrated circuit control the NOT PRESET signal, depending upon the settings of the A-Position, B-Position, and Trigger Level switches.



NOTE

1. IC1 IS 7437
2. RESISTORS R1 & R2 ARE ¼W, 5%



NOT PRESET LOGIC SCHEMATIC AND ASSEMBLY 625-081

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